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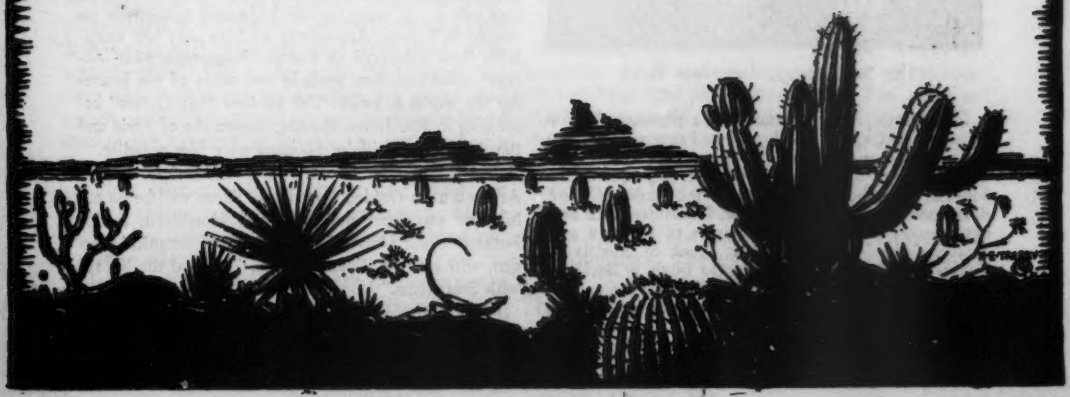
CACTUS AND SUCCULENT JOURNAL

VOL. XXXIII JULY-AUGUST, 1961 NO. 4

Fig. 49. Echinocereus collection of Marjorie Shields in New Zealand.



CACTUS AND SUCCULENT JOURNAL

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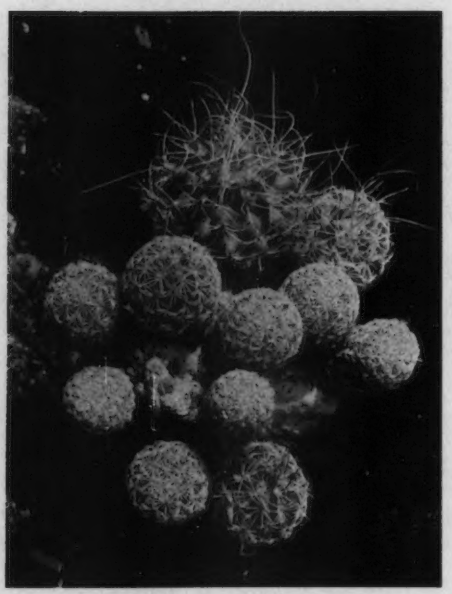

Fig. 50. *Toumeya krainziana* Frank

Last month's cover picture was a photograph of a plant which Gerhart Frank collected several years ago and now flowering in the collection of Scott Haselton. We had hoped to show the flowers in this issue of the Journal. The above picture shows the stages of plant development all on the same root. It was described as a new species in the November issue of *Kakteen und Andere Sukkulenten* by Gerhart Frank of Austria as *Toumeya krainziana* (*Turbinicarpus* Buxb. et Backbg.; *Toumeya* comb. nov. Bravo et Marshall).

CACTUS & SUCCULENT SOCIETY OF CALIFORNIA

The Cactus and Succulent Society of California met May 14, the second Sunday, in the Oakland Garden Center.

Aeoniums and their relatives were discussed at the "study session". Mr. Butterfield gave a talk on aeoniums in general illustrated with a number of specimens. Mr. Al Irving brought some newly introduced species from the University Botanical Gardens; also some very interesting and unusual monathes—single flowered relatives of the aeoniums. Dr. Dodson brought in some I. S. I. introductions. One, aeonium balsamiferum, gives off the odor of evergreens.

Mr. Small brought in a number of hybrids of his own crossing and those from some Southern California growers. Mrs. Genasci, Mrs. Shepherd and Mrs. Green brought in plants for discussion also some to be identified. Mrs. Bogle brought in a hardy variety not identified by us as yet. It is one that forms clusters of rosettes very low to the ground and stands 20° and 22° temperatures in the Sacramento area.

Mr. Dodson also brought in a group of new "pot size Aloes": A. parvula, A. albiflora, A. jacksonii, A. bakerii. These were all in bloom in 5 inch pots, very attractive for small gardens or windows.

The main meeting had my favorite speaker, Mr. Paul Hutchison, a member of our Society, show pictures and tell us of some of the succulent collections he visited in Europe. Apparently we have very few succulents here compared to Europe. Europeans with millions make succulent gardens and miles of hot houses for the world to enjoy. The gardens "Les Cedres" belonging to Mr. Julien Marnier Lapostolle of Paris and the one on the cliffs at Monaco were like paradise.

Our society is sponsoring a benefit for the Strybling Arboretum in Golden Gate Park. There will be an exhibit of succulents and Mr. Paul Hutchison, Senior Botanist at the University of California Botanical Garden, will give an illustrated talk, "Around the World with Succulents."

Fig. 51. *Echinocereus baileyii*

DESERT FLOWERS UNDER GLASS

The story of my experiences and delight in growing and flowering Cacti and Succulents in a small glasshouse in Christchurch, New Zealand

By MARJORIE E. SHIELDS

Chapter 21
ECHINOCEREUS
Part II

From Oklahoma comes E. baileyii, a strikingly beautiful, finely ribbed plant. The round areoles are almost continuous down the cylindrical body, with the dense, fine spines interlocking to hide the plant. Rose pink spines which fill the crown fade to cream as they descend the stem. As yet, this plant has not multiplied. The flower has many narrowish, ragged, rose pink petals, the outer ones with a deeper mid rib and all tapering narrowly at the base, where they fade to a pinkish coppery hue. The thick cluster of bronze green stamens stand erect round the soft green stigma lobes. A lovely flower on a colourful plant. Next to it is an exceedingly handsome cluster which is disappointing as it has failed to flower. It is E. engelmannii, found in many places such as California, Mexico, Arizona, etc. It has clustered from the base with short, stout upright stems. The spines make the plant attractive, the horizontal radial ones are short and cream, while the centrals are variable, some being two inches or more in length, the longest being cream with a reddish brown tip, this colour descending like a stripe. Shorter fine ones are stained cream, red and brown, even some of the radials are coloured. Is it any wonder this plant looks so alluring?

In complete contrast is dainty E. albispinus, a cluster of small, globular, green balls in varying sizes, the largest being about the size of a walnut. Each is striped with white areoles which are continuous down the ribs and from which radiate short, fine, white spines, almost obscuring the plant. In winter these are faintly tinted cinnamon, but during the summer months are pure white. It has the daintiest of pinkish mauve, sweetly scented flowers, with narrow petals deepening in colour towards the twisted, feathered tip, each ending in an awn. At the base of the petals are vieux rose and these surround a loose bunch of lime green stamens with yellow anthers. The mossy green stigma lobes are held above them on a white style. How such a delicate blossom can withstand the rigors of a desert is a mystery. The little clustering plant could be half buried in the sand, but not the blossoms which look as though the slightest breath would bruise them.

Here is another totally different, looking like a small Cephalocereus senilis which had wandered into the wrong group. But, no, this is its rightful place as it is E. de laetii, sometimes called "the Old Man's little boy". The plant is about 6 inches high with long white coarse hair, but is not as thickly covered as the "Old Man". There are cream spines there too, concealed amongst the hair, those in the crown being tipped with cinnamon. This plant has yet to flower. This one with the feathered petalled blossoms is E. longisetus. The pale pinkish purple flowers shade to almost white and then to a maroon circle round the thick bunch of cream stamens,

Fig. 52. Left to right. Top row: Echinocereus albispinus ,E. de laetii, E. melanocentrus. Second row: E. fitchii, E. sciurus, E. berlandieri. Third row: E. procumbens, E. pentalophus, E. scheeri. Bottom row: E. stolonifera, E. chihuahuaensis, E. fereirrae.

through which push the many soft green stigma lobes. The areoles on the flower tube are filled with thick white wool and long, very fine, white and red hairs, making a soft woolly comforter for this dainty blossom. The erect stem is covered with fine white radial spines and the very long slender, flexible centrals all point upwards. The name means "with long bristles".

The next group of four are all clusters, with short, oval to cylindrical stems and with short spines like those on E. fendleri. This is a good cluster with low rounded ribs and wide apart areoles. The spine clusters are not at all dense, but the spines are fine and multicoloured, some being white, others brownish, other again variegated. Again this is one that has not flowered. E. melanocentrus is typical of this group, with its many ribs edged with closely spaced areoles.

Short white spines, brown tipped, radiate from the tiny oval areoles, while in the centre of each is a longer brown one, but even this would be scarcely half an inch in length. The flower too, differs from the others in that it has a wide throat and the many deep magenta petals recurve and open flat to show the wonderful colour in the deeper red throat. The red filaments shade to yellow to match the anthers while the pink style breaks into pinkish green stigma lobes. A very lovely flower indeed.

Here is E. fitchii rather similar. These small yellowish spine clusters have no central. But how the spiny, hairy, woolly overy sets off the flower! It is most attractive. Deep pink petals with feathered edges shade to red in the throat, which is filled with pink stamens and stigma lobes in a soft resida colour. The oval blossom looks as though it has been flattened sideways, because the style is oval instead of round and the stigma lobes are in two rows. The last one in this group is E. sciurus. This differs from the others only because it is a grafted plant and is growing profusely, small fully developed offshoots bursting through the main stems at all angles, until it looks more like a queer animal than a plant. It is a real show plant and in the distance appears to be covered with white fur. Perhaps that is why it is called sciurus "a squirrel"! On closer inspection the fur proclaims itself as fine white spines. The flower is as lovely as the plant, with bright pink blossoms 3½ to 4 inches across, paling towards the base, where greenish yellow filaments tightly clasp the style. The anthers look like a little yellow frill surrounding the light green stigma lobes. The tube is short and very spiny.

In the next group we have an assortment of plants with long cylindrical, soft and usually sprawly stems, not particularly attractive and difficult to repot without doing some damage which disfigures the plant. No matter how careful one tries to be, either a fat sausage or a finger-like stem, or worse still, a broken one, will be found lying with the discarded soil. Although these plants are not spectacular, they have the largest flowers of all. Here in the centre of the group, because of its size, is E. berlandieri. When not in flower this plant is quite uninteresting, just a collection of sausage-like stems, but when blooming is one of the most spectacular sights in the glasshouse. As the plant is very large an ordinary flowerpot did not seem to be the right shape for it, so it was planted in a jardiniere painted dark green, with a hole drilled in the base. It is wide and not too tall for its depth, as a pot would be, and is most suitable for such a sprawling plant. It has excelled itself this year, with 30 buds! Fortunately they are not all going to open at once. There would not be room for them on the branches if they did, for these flowers are very large, 6 to 7 inches across, with pinkish-purple petals, shading to white in the throat and with orange stamens and emerald green stigma lobes. These stigma lobes are a flower in themselves, measuring an inch across. The stamens are tightly packed against the style and sweep round it in a swirl. Many other Echinocereus flowers are just as beautiful, some more so, but as the plants are small, they cannot hope to put on a display to compare with E. berlanderi.

E. procumbens "prostrate or lying on the ground" is more pleasing to the eye than others in this group. The clustering stems are about the thickness of a man's finger, with short stumpy spines, 4 to 6 to an areole, while on some of the more mature stems there are also long, strong centrals pointing upwards. The flowers are large and saucer shaped, opening wide to the sun. Clear pinkish mauve petals come to a blunt point and shade through white to pale green in the throat, surrounding a tight cluster of pale green filaments with salmon anthers through which the green stigma lobes push their way.

E. pentalopus will some day be as large, if not larger, than E. berlandieri. The thick stems are long and sprawling and eventually will need support, some already being a foot in length. The fine spines are unattractive, there being 4 only to an areole. But the flowers make up for it. They could best be described as white, the broad end of the petals brushed with pinkish purple and lightly feathered, tapering to a narrow base. The pale yellowish green colour of the filaments stains the base of the petals. Golden yellow anthers and moss green stigma lobes complete this striking looking flower. There is something quite different about each one.

See what long, narrow petals there are to that flower of E. viereckii? Sharply pointed too, and tapering so narrowly at the base it is surprising they can keep their hold. Light violet in colour with a slightly deeper mid rib and with very short stamens in an untidy bunch filling the throat, while light green stigma lobes rise above them. The plant has stems of bright grass green and is very plump. Cream areoles placed fairly close together form cushions for the five cream spines, the central being much longer than the radials.

Then there is E. scheeri with its clusters of dark olive green shorter and finer stems, with short cream spines, from areoles spaced but half an inch apart and flowers quite different from the wide saucer shaped pinkish purple ones of the last group. These trumpet shaped blossoms are pink suffused with orange and with the sun shining on them they are beautiful. Held on a fairly long tube which is covered with wool and very fine hair they add considerably to the beauty of the flower. The write filaments shade to deep

pink and are topped with salmon pink anthers bunched round the very long style. The bright green stigma lobes remain closed like a bud and protrude beyond the petals, and when the flower closes at night, it looks as though it has left its little green tongue hanging out!

The next three also have trumpet shaped flowers, but on a different type of plant growth. They could almost be called trailers and are somewhate reminiscent of an Aporocactus. "Pendent" E. pensilis has hanging stems nearly three feet in length, and about three times the thickness of an Aporocactus tail. This is, I think, the only Echinocereus with trailing stems. Much to my delight flowers adorn both long tails. They were definitely worth waiting for. The trumpet shaped blossoms could be termed double as there are two distinct rows of petals bright salmon pink in colour, the inner row in a slightly deeper shade and with an overlay of lilac. The long stamens reach almost to the top of the petals and tiny cream anthers match the loose bunch of filaments filling the centre of the flower, the pinkish cream stigma lobes rising above them. The tube is short and covered with white bristles. Did you notice the stigma lobes are pinkish cream and not green? This is most unusual, for the majority of Echinocereus have green stigma lobes. This plant comes from Lower California.

Here is another little gem with trumpet shaped flowers in soft coral, with green stigma lobes and deep down in the throat the filaments are also green. But these shade to pink at the tips and are topped with yellow anthers. The flower is but 1½ to 2 inches across but makes up in numbers and beauty what it lacks in size. Also it lasts for several days, fading to soft salmon pink. Its name is E. stolonifera, so called because it produces stolons, which are "slender shoots or stems growing from the base of the plant usually underground." This plant too, is like an Aporocactus with short tails, the stems being very little stouter.

E. chihuahuaensis from Chihuahua, Mexico, is similar, only in a larger edition, its largest branches being 10 inches in length. There is a large cluster of tails with spines that are insignificant. But not so the flowers! These are bright red! The petals are incurved to form a goblet, whereas those of E. stolonifera are recurved to form a trumpet. White filaments at the base shade to deep magenta with biscuit coloured anthers. The extended stigma lobes are tightly clasped and look like a green ball on the end of the cream style. The tube is long, with thick white wool in the areoles, green at the base changing to copper colour as it merges into the flower. These lovely blossoms though smaller are even more beautiful than the large saucer shaped blooms.

Fig. 53. *Echinocereus pensilis*

There there is E. fereirrae, purposely left to the last because it is so different from any of the others. The plant is a cluster of light blue/green stems with 12 ribs and short bleached radial spines with brown tips which lie flat against the body. Of the four fine brown centrals the longest is 1½ inches, the new spines in the crown are golden brown. Nothing very different about that, is there? But the flower . . . ! It is cup shaped with incurved petals like a pinkish mauve water lily with an exotic tangerine centre! The petals have a deeper purplish mid rib, changing colour abruptly as it deepens toward that bright tangerine centre. The filaments also are tangerine with pale cream anthers, while the style is pinkish mauve to tone with the upper portion of the petals. It stands well clear of the stamens to display the cream stigma lobes. This blossom when held to the light glows with colour through the tube just as we saw it in Astrophytum capricorne. This is unique colouring for an Echinocereus and once again the stigma lobes are cream. Strange! For this one too, comes from Lower California!

That is the last of these glorious blossoms just now, but interest in this group will not fade, for there are several young plants coming along and these will flower in time; also more and more will be added in the years to come, especially those with blossoms of red, orange or yellow, as pink predominates at the moment. So with a last lingering glance we pass on to the next group.

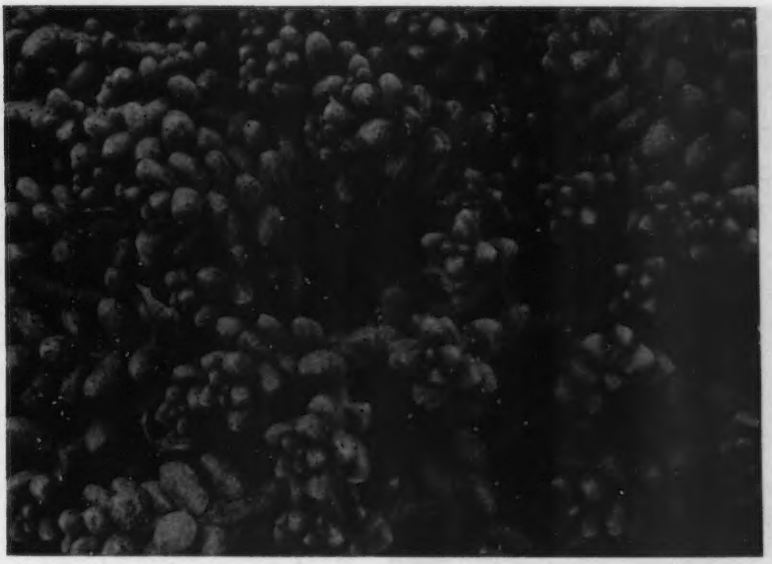

Fig. 54
Sedum furfuraceum as it grew at the type locality, November 1959. Natural size.

Sedum furfuraceum

A new species from San Luis Potosí, México

By REID MORAN

In the late fall of 1959, under the auspices of the San Diego Museum of Natural History, Myron Kimnach and I spent six weeks collecting in Mexico, paying particular attention to Crassulaceae. It would be hard to name the most interesting area we visited, for almost every day we found intriguing plants—some familiar to us from cultivation but perhaps with few or no known wild localities, some vaguely known from descriptions, and some quite strange and new.

A memorable afternoon was one we spent in the western foothills of the Sierra de Alvarez east of the city of San Luis Potosí, on the road to Zaragoza and beyond. It did not seem extravagant to find in the one afternoon five kinds of *Sedum* and one each of *Echeveria, Pachyphytum,* and *Villadia,* to say nothing of cacti. Our most interesting stop was on a pine-covered hillside above the Ranchito de Juárez. On a north-facing cliff grew *Sedum palmeri* and *Pachyphytum* sp. resembling *P. hookeri,* which, however, has not flowered to reveal its identity. On the shaded slope were many beautiful plants of that old garden favorite *Echeveria agavoides,* for which the monograph of Britton and Rose gives no locality more precise than "Mexico" and that of von Poellnitz no locality other than "San Luis Potosí".

But most remarkable of all was a strange sedum forming coarse mats in the peat-like duff on pine-shaded rocks. The creeping stems with upturned ends bore egg-shaped leaves a third of an inch long crowded in 5 spiral rows, dark green but somewhat frosted with tiny dandruffy scales peeling from the surface. This curious plant called to mind some of the compact South African crassulas, though of course they differ in having the leaves opposite and so in four rows instead of five.

In March and April of 1961, this plant flowered at San Diego, permitting the description of what appears to be a new species of *Sedum.*

Sedum furfuraceum sp. nov.

Planta glabra; caules perennes, decumbentes, ½-1½ dm longi, basi ad 8 mm diametro, cortice cano molli; folia alterna, in 5 seriebus subtortuosis conferta, ovoidea, obtusa, circiter 9 mm longa et 5 mm lata, cuticulam in forma furfuris albi deponentia; inflorescentia terminalis, sessilis,

Fig. 55. *Sedum furfuraceum* flowering in San Diego, 28 March 1961. × 3.6.

conferta, ex 1-3 floribus constans; flores subsessiles, roseo-albi, 8-10 mm diametro; sepala elliptico-ovata, ad 2½ mm longa, latitudine subinaequalia; petala lanceolata, acuta, 4½-5 mm longa, ½-1 mm connata; squamae subquadratae, subrutilae; pistilla 3½-4 mm alta, brevistylia, sub fructu adscendentia.

Glabrous perennial. Stems prostrate to ascending, branching sparsely throughout, growing sympodially past the terminal old inflorescences, ½-1½ dm long, ca. 1½ mm thick near the apex, 3 mm thick at the base of the leaf-bearing part, and 8 mm thick at the base, not terete but flattened at each leaf attachment, near the apex crowded-papillose, the papillae ca. 0.1-0.2 mm wide, soon withering orange-brown, some of them turning black and persisting to roughen the stem after leaf-fall, the internodes ca. 1 mm long, the leaf-base site oval, ca. 3 mm wide and 2½ mm high, scarcely evident after leaf-fall except as a flattened area, the leaf attachment oval, 0.5-1.2 mm wide, 0.3-0.5 high, the stem surface yellow-green, soon obscured except at a few irregularly distributed fissures by a grayish white persistent and thickening soft somewhat flaky bark. Leaves dark green or in strong sunlight somewhat purplish red, alternate, 20-35 crowded in 5 obvious parastichies in the upper 1½-3 cm of the stem, subtriquetrous-ovoid, obtuse, 6-11 mm long, 4½-6 mm wide, 4-5 mm thick, the margins and keel evident as obtuse ridges in the apical half or at least near the apex, the surface at first shiny, soon appearing somewhat frosted as the cuticle splits irregularly into flakes ca. 0.1-1.0 mm wide, which become partially free but persist on the surface. Inflorescence terminal, sessile and crowded, of 1-3 flowers, when 3-flowered a uniparous or biparous cyme, whose flowers open at intervals of mostly ca. 6 (-14) days, each axis with ca. two bracts, which wither before fructescence. Bracts elliptic-oblong, obtuse, subtriquetrous, each with thin acute margins, rounded keel, and concave ventral face, the lower ca. 3½ mm long, 1½ mm wide, and 1 mm thick, the upper about half as large. Pedicels ca. 1 mm long and slightly thicker, irregularly rugose-papillose. Buds ovoid, acutish. Flowers in March and April (at San Diego), pinkish, 8-10 mm wide, each open for ca. 10 days. Sepals ascending, appressed to the corolla, often somewhat asymmetrically placed, elliptic-ovate, obtuse to rounded at the apex, rounded dorsally, concave ventrally, with somewhat flaky cuticle especially towards the margins, 2.2-2.5 mm long, 1.2-1.7 mm wide, 0.5-0.6 mm thick, those of one flower about equal in length but unequal in width especially because of the varying width of the thin acute margins. Petals non-convolute in the bud, connate ½-1 mm, broadly lanceolate, acute 4½-5 mm long, 2-2½ mm wide just below the middle and about half as wide at the base, channeled ventrally for about the width of the filament, somewhat scurfy dorsally, white, in the distal half purplish red on the keel and pinkish in the center ventrally, the proximal half ascending, the distal half horizontally spreading or usually somewhat reflexed after ca. 2 days, finally withering in an ascending position. Stamens erect as the flower opens, the epipetalous remaining against the petals as they spread but erect again by the end of the second day, when their anthers have dehisced, all stamens ascending to spreading after the fourth day; filaments white, tapering from the base, 3-3½ mm long, 0.3-0.4 mm wide at the base, the antesepalous adnate ca. ½ mm, the epipetalous slightly wider, adnate ca. 1 mm; anthers before dehiscence low red-muriculate on a yellowish background and thus light red, subovoid, flattened and somewhat channeled lengthwise on the four sides, 0.7-0.8 mm long, 0.5-0.7 mm wide, 0.4-0.5 mm thick, the antesepalous dehiscing the first day, the epipetalous on or before the second day. Nectar

scales yellowish minutely dotted with red, subquadrate in dorsal view, obcuneate in lateral view, ca. 0.4 mm high, 0.3 mm thick at the base, 0.5 mm wide. Pistils white or pinkish, 3½-4 mm high, at first erect and appressed, gradually thickening and separating in the upper third until at the end of anthesis adjacent stigmas are ca. 1½ mm apart, the ovaries 2½-3 mm high, ca. 0.8 mm wide, at first ca. 0.9 mm thick, becoming ca. 1.3 mm thick, somewhat keeled dorsally and humped two-thirds above the base, connate ca. 1 mm by the ventral margins, narrowing abruptly to styles ca. 1 mm long, the marginal lips ca. 0.3 mm wide; placentae ca. 1½ mm long, with ca. 14-17 ovules, the lower horizontal to declined, the upper ascending; ovules clavate, ca. 0.6 mm long and 0.25 mm thick. Follicles red, drying reddish, the ovaries ca. 3 mm high, 1.6 mm thick, and 0.8 mm wide, before dehiscence erect and in contact in the lower two-thirds, the inner margins ascending above at ca. 45°. Seeds reddish brown, narrowly obovoid, 0.6-0.7 mm long, 0.25-0.3 mm thick, reticulate-pitted in ca. 20 longitudinal rows. Chromosome number: n=34.

TYPE: Forming a coarse mat on rocks, pine-covered hillside at 2100 m, above Ranchito de Juárez, 11 miles by road southeasterly from Zaragoza, San Luis Potosí, México (near 21° 59′ N, 100° 42′ W), 7 November 1959, *Moran & Kimnach 7659;* flowering at San Diego, California, 28 March 1961 (SD 51098). Living plants of the type collection were sent to the Instituto Nacional de Investigaciones Forestales, in Mexico; to the Sociedad Mexicana de Cactología, A. C.; and to the International Succulent Institute, which will distribute plants when enough are propagated.

The relationships of *Sedum furfuraceum* are not clear. The Mexican sedum whose leaves are most similar in size and shape is *S. stahlii* Solms; but that plant has thinner stems, longer internodes, opposite puberulent leaves that often are orange-red, and more numerous and larger yellow flowers. Perhaps *S. furfuraceum* is closest to such smaller plants as *S. moranense* HBK, which has perennial stems, crowded thick alternate leaves, terminal inflorescences of few to several subsessile white flowers, and spreading follicles with short styles and rather wide marginal lips. From *S. moranense* and its relatives, it differs in its larger stems and leaves, peeling cuticle, thick soft bark, and uniformly small and compact inflorescence.

Dr. Charles H. Uhl of Cornell University has made a chromosome count from material of the type collection. He reports a gametic chromosome number of 34.

Seeking the Elusive Agave huachucensis

By Don B. Skinner

We have known this Agave (in our gardens) since 1930. It is the most sought after of the larger Agaves for garden work in Southern California. Those in our gardens were first distributed by the Huntington Botanic Gardens; few are to be found in nurseries, and these are high priced. Most of the plants brought from Arizona have been *Agave parryi.* While the type location for *A. huachucensis* is purported to be the Huachuca Mountains of Southern Arizona, on our first trip hunting it, though we were told it grew on the grassy plains of Patagonia, we found it growing only in the streets of Nogales.

On two trips we failed to find it, though we saw plenty of *A. parryi* and *A. palmeri.* So, on our recent trip we arranged with Mr. George Olin, Naturalist of Saguaro National Monument, to go with us (he having driven that country for twenty odd years) so that we might collect seeds and get photographs.

Most of the seedlings we had seen grown in nurseries we considered to be *A. parryi,* not *A. huachucensis,* and had come to the conclusion that the latter must be a Mexican species, rather than an Arizona one, as even seen growing in Arizona gardens the plant resembled *A. parryi* rather than its variety, *A. huachucensis.*

Being taken to the Arizona habitat by Mr. Olin, we found it to be about half-way between Sonoita and Patagonia, growing on the wide open plains. Here we found only two large colonies, the first growing on the high (almost swampy) grasslands at about 5,000 feet, the second (still in moist ground) a grassy hillside above meadows, at least fifty acres in this group. This section of the country is noted as being one of the moistest spots in the state. At this spot we found some plants similar to the plant we have here in Southern California. We saw very few seedlings, but many mature plants had huge offsets and innumerable stolons. The latter, the size of baseballs, might be as far as six feet from the parent plant. Plants in these colonies ran from beige-green to almost dusty-blue-green, with coarse brown or black marginal hooked teeth.

A. huachucensis while not as large (single

Fig. 56. The author views a colony of *Agave huachucensis*.

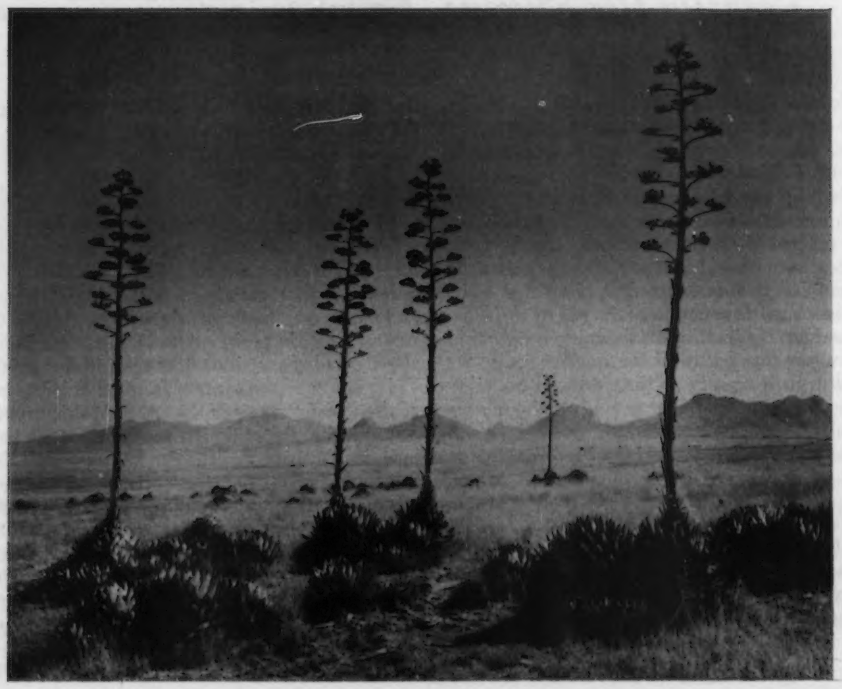

Fig. 57. *Agave hauchucensis* on the grassy plains. George Olin photos.

specimens) as *A. palmeri,* grows in immense colonies, and the specimens and flower stalks are by far the most robust of any *we* have seen, native to the states. A characteristic of this Agave is the tight cabbagy head which impresses each cupped leaf firmly on its enclosing mate in a beautiful pattern—a distinctive feature. In our experience *A. huachucensis* tends to have broader leaves, rounder at the tips, the leaves thick at broadest part. Flower stalks run 16-25 feet tall and are exceedingly heavy, with green-yellow flowers, blooming June to August. Fortunately we found a young offset blooming in December.

Because of the slow rate of growth, this plant will never become too common in gardens. Both locations showed its preference for a moist heavy soil. Seeds are very viable, germinating readily, but, like the parents, seedlings are inconceivably slow-growing.

The accompanying excellent photographs taken by George Olin show the massive clusters, immense flower stalks, and generally fascinating beauty of this Agave.

Fig. 58. *Sedum* sp. *(Sedum hintonii?)* nat. size

An Interesting Sedum

By J. R. BROWN

One of the most handsome of Sedums is in cultivation under the name of *Sedum hintonii* Clausen, this is a very pubescent plant and when it flowered recently it seemed to be quite distinct from the Sedum described and figured by Clausen[1]. The leaves are differently shaped and more spreading, the inflorescence is very condensed, the flowers are much larger with very reflexed petals, etc. This Sedum came from Mexico without locality and while one of the most beautiful plants of the genus does not seem entitled to the name *hintonii* and it is hoped that it may be more fully investigated.

[1]Clausen, Robert T. The section Sedastrum of Sedum, Bull. Torrey Bot. Club 70: 292, 1943.

New Bolivian Cacti

By M. CARDENAS

PART VII, Concluded

Parodia splendens Cárd. sp. nov.

Simplex globosa plus minusve 10 cm. alto 11 cm. lata diluto viridis vel glauca. Costis plus minusve 13 parce spiralibus 1-1.5 cm. altis, 1.5-2 cm. latis. Areolis 12-15 mm. inter se distantibus, circularibus 4 mm. diam. griseis vel bruneis tomentosis. Aculeis radialibus 12-14 tenuibus acicularibus, radiantibus compressis 2-4 cm. long.; centralibus 1-3 subulatis deorsum curvatis 4-10 cm. long. Omnes aculei albidi a basi brunescente. Apice umbilici aculeis roseis vel diluto bruneis sursum directio, lana alba praedito. Floribus numerosis ex apice pulvini late infundibuliformibus vel urceolatis 4 cm. long. Ovario globoso 5 mm. long. 8 mm. lato, roseo, squamis minutis albidis pilis densis albis praedito. Tubus brevis roseus superne patens, squamis albidis acutis, pilis albis praeditus. Phylla perigoni exteriora linearia inferne flava, superne purpurea 1 cm. long.; phylla interiora lanceolata 17 mm. long. flava. Stamina ab tubi fundo usque ad basim petali 10-12 mm. long.; filamenta flava nitentia; antherae flavae. Stylum 2 cm. long. flavus crassus 9 radis stigmaticis flavis 4 mm. long. coronatus.

Patria: Bolivia. Provincia Sud Cinti. Departamento Chuquisaca in itinere Las Carreras—Chaupi Unu 2,500 m.

Globose, about 10 cm. high, 11 cm. broad, light green to glaucous. Ribs about 13 slightly spiralled 1-1.5 cm. high, 1.5-2 cm. broad. Areoles 12-15 mm. apart, circular 4 mm. diam., gray to brown felted. Radial spines 12-14 thin acicular spreading and laterally compressed 2-4 cm. long; centrals 1-3 subulate curved downwards 4-10 cm. long. All spines white, brownish at base. Upper spines pink to light brown directed upwards 2-6 cm. long. Flowers numerous from a cushion of white wool at the top of the plant. Flowers broad funnelform or urceolate 4 cm. long, 4 cm. limb covered by a dense white wool up to the base of petals. Ovary 5 mm. long, 8 mm. broad, pink with few minute whitish scales bearing dense white curled hairs. Tube short, pink, with whitish acute scales which bear white hairs. Upper scales 3 mm. long; uppermost scales with whip-like bristles. Outer perianth segments linear, purplish yellow at base, 1 cm. long; inner segments alternating with the outer ones lanceolate 17 x 4 mm., bright yellow. Stamens from the bottom of the tube to the base of petals 10-12 mm. long; filaments thin, yellow, shining. Anthers yellow. Style 2 cm. long, yellow, thick. Stigma rays 9, yellow, 4 mm. long, thick.

Fig. 59
Parodia splendens: 1-2 flower, 3-4 outer and inner

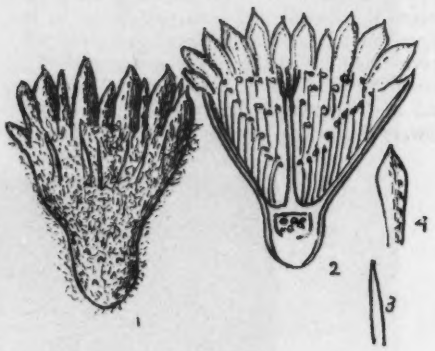

Fig. 60
Parodia splendens: 1-2 flower, 3-4 outer and inner perianth segments, x 1.0

Bolivia. Province of Sud Cinti. Department of Chuquisaca. On the way Las Carreras to Chaupi Unu. 2,500 m. April 1958. M. Cárdenas No. 5527 (type) in Herbarium Cardenasianum.

Obs. This southern Bolivian cactus attracts attention at once on the borders of the high way from Las Carreras to Chaupi Unu by its white glossy spines and its general superb appearance.

Parodia tarabucina Cárd. sp. nov.

Globosa simplex 20 cm. alta, 25 cm. crassa. Costis 13 fere spiralibus 1.5 cm. altis, 2 cm. latis. Areolis 1 cm. remotis, ellipticis 7 mm. long. cinereo tomentosis.

Fig. 61
Parodia tarabucina sp. nov.

Aculeis marginalibus 12-13 acicularibus compressus 1-3 cm. long.; centralis uno apice fere curvato 5-7 cm. long. subulato. Flores numerosi ex apice lana pulvinulo cormorum, urceolati 5 cm. long. 4 cm. diam. Ovario globoso 8 mm long. albido, squamis minutis, pilis albis praedito. Tubus patens infundibuliformibus, squamis minutis albidis, pilis inferne purpureo flavidis superne purpureo salmoneis instructus. Phylla perigoni linearia lanceolata salmoneo purpurea. Stamina 10-13 cm. long. tenuissima diluto flava; antherae temperato flavae. Stylus 3 cm. long. stamina superans, diluto flavus, 17 radis stigmaticis brevis flavis introrsum curvatis coronatus.

Patria: Bolivia. Provincia Oropeza. Departamento Chuquisaca in itinere Sucre-Tarabuco, 2,900 m.

Globose, simple, 20 cm. high, 25 cm. broad. Ribs 13 slightly spiraled 1.5 cm. high, 2 cm. broad. Areoles 1 cm. apart, elliptic, 7 mm. long, gray felted. Radial spines 12-13, compressed, 1-3 cm. long acicular and some very thin. Central spine 1 slightly hooked downwards 5-7 cm. long, subulate. Top spines directed upwards brownish. Other spines whitish. Flowers various from a wool cushion at the top of the plants, urceolate 5 cm. long, 4 cm. limb. Ovary 8 mm. long, globose, yellow whitish with minute scales bearing white hairs. Tube widening above 2 cm. long with minute whitish scales which bear purple yellowish below, purple salmon hairs. perianth segments linear lanceolate, bright salmon-purple. Stamens from the bottom of tube to the base of petals 10-13 mm. long thin, light yellow; anthers light yellow. Style 3 cm. long longer than stamens light yellow. Stigma rays 17 short, yellow curved inwards 2 mm long.

Bolivia. Province of Oropeza. Department of Chuquisaca. On the way Sucre to Tarabuco, 2,900 m. February 1949. M. Cárdenas No. 5528 (Type) in Herbarium Cardenasianum.

Obs. It is hard to identify by its original description, *Echinocactus maassii* Heese. Our species resembles this one, but differs by its less spiraled stems, different spination and larger flowers which are not copper red, but purple salmon red.

Parodia miguillensis Cárd. sp. nov.

Simplex claviformia diluto viridia, 6 cm. long. 4 cm. crassa. Costis 13, fere spiralibus, acutibus, 5 mm. altis, 8 mm. latis. Areolis 2-3 mm. remotis, 1-1.5 mm. diam. prominentibus, diluto brunei tomentosis. Aculeis 16-20 radiantibus 2-10 mm. long. acicularibus, luteo albescentibus vel diluto bruneis. Flores ex apice lana brunea tubulosi 18 mm. long. 7 mm. diam. Ovario globoso 5 mm. diam. roseo, squamis acutis, pilis albis densis praedito. Tubus 7 mm. crassus, squamis longis acutis, pilis bruneis, setis bruneis instructus. Phylla perigoni exteriora spathulata, 5 mm. long. lutea; phylla interior spathulata superne diluto lutea, inferne alba. Stamina ex fundo tubus usque basim petalia. Filamenta tenua, lutea; antherae flavae. Stylus 1 cm. long. diluto flavus, 6 radiis stigmaticis flavis coronatus.

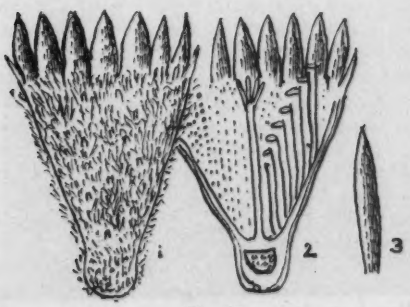

Fig. 62
Parodia tarabucina: 1-2 flower, 3 perianth segment, x 1.

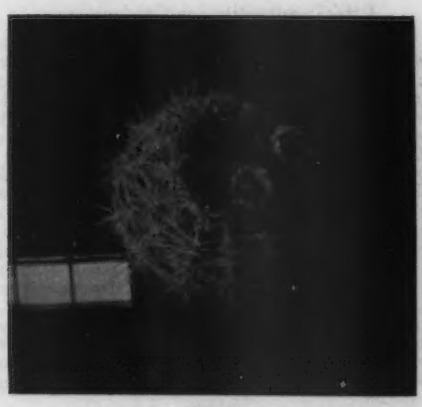

Fig. 63
Parodia miguillensis sp. nov.

Patria: Bolivia. Provincia Sud Yungas. Departamento La Paz in itinere Miguilla-Plazuela, 1,200 m.

Stems simple, club-shaped, light green, about 6 cm. long and 4 cm. thick at its broadest section. Ribs 13 very slightly spiralled, acute, 5 mm. high, 8 mm. broad. Areoles 2-3 mm. apart, 1-1.5 mm. diam., prominent, light brown felted. Spines 16-20, spreading, some very thin, whitish yellow, others thicker and light brown. Shortest spines, 2-3 mm. long medium sized one 6 mm., longest ones 10 mm. Flowers form a top brownish wooly cushion, tubulous, 18 mm. long, 7 mm. limb. Ovary 5 mm. diam., pink with acute narrow scales bearing dense white wool. Tube covered by long acute scales bearing brownish wool and brown bristles. Outer perianth segments spathulate, 5 x 2 mm., yellow with a red central line. Inner segments spathulate, 5 x 1.5 mm., light yellow above, white below. Stamens from the bottom of tube to the base of petals. Filaments white, yellowish; anthers yellow. Style 1 cm. long, light yellow. Stigma rays 6, yellow, each one tapering.

Bolivia. Province of Sud Yungas. Department of La Paz. On the way from Miguilla to La Plazuela, 1,200 m. M. Cárdenas, No. 5539 (Type) in Herbarium Cardenasianum.

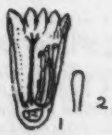

Fig. 64
Parodia miguillensis: 1 flower, 2 perianth segment, x 1.0

Obs. This is the northernmost species of Parodia found. It is distinguished by its club shaped and very small stems.

Lobivia aureolilacina Cárd. sp. nov.

Globosa simplex 7-8 cm. alta, 13-14 cm. lata griseo viridis. Costis plus minusve 18 acutis in tubercula securiformia solutis. Areolis 3.5-4 cm. remotis ellipticis cinereo tomentosis. Aculei radiales 8 pectinati 1.5-3.5 cm. long.; centrali unus 3-7 cm. long. Omnes aculei subulati cinereo albidi apice curvati a basi incrassati. Flores pauci pleurogeni 7 cm. long. Ovario globoso 1 cm. diam., squamis acutis 5 mm. long. viridibus, pilis albis praedito. Tubus 2.5 cm. long. 1 cm. crassus superne patens, squamis acutis viridibus, pilis albis et atro bruneis instructus. Phylla perigoni exteriora lineari lanceolata 3.5 cm. long; phylla intermedia 3.5 cm long. lanceolata mucronata aureo lilacina; phylla interiora spathulata 3 cm. long. flava. Stamina inferiora ex 1 cm. supra fundum tubi usque 1 cm. infra petalorum 2-2.5 long. Filamenta superne flava inferne viridia. Stamina superiora 12 mm. long.; filamenta alba. Omnes antherae flavae. Stylo 2.5 cm. long. superne flavo inferne viridi 8-12 radis stigmaticis gracilibus flavis 1 cm. long. coronato.

Patria: Bolivia. Provincia Sud Cinti. Departamento Chuquisaca, prope supra Impora, 2,750 m.

Globose simple 7-8 cm. high 13-14 cm. broad gray green. Ribs about 18 acute broken in hatched tubercles 1-1.5 cm. high, 1.5 cm. broad. Areoles 3.5-4 cm. apart, elliptic 1 cm. long obliquely inserted in the crenae of ribs, gray felted. Radial spines pectinate 4 to each side of the areole 1.5 to 3.5 cm. long. Central spine 3-7 cm. long. All spines subulate strong horn gray to whitish hooked at apex swollen at base. Top depression of stem unarmed. Flowers few from the upper lateral section of stem 7 cm. long 7 cm. limb. Ovary globose 1 cm. diam. with acute 5 mm. long green whitish tipped scales bearing white hairs. Tube 2.5 cm. long, 1 cm. thick above ovary, widening slightly above with 7-8 mm. long green acute scales which bear white and dark brown hairs. Outer perianth segments linear lanceolate 3.5 x 0.4 cm. green lilac; middle segments 3.5 x 0.6 cm. lanceolate mucronate, yellow lilac; inner segments spathulate light yellow 30 x 11 mm. Stamens in two rows. Lower ones from the bottom of tube to 1 cm. below upper stamens 2-2.5 cm. long; filaments green below yellow above; upper stamens 12 mm. long, filaments white. All anthers yellow. Interior of the flower tube white. Style 2.5 cm. long 2 mm. thick green below yellow above. Stigma lobes 8-12 thin yellow 1 cm. long.

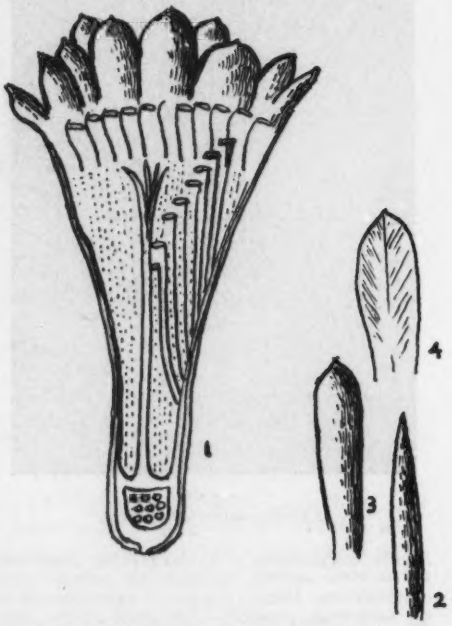

Fig. 65
Lobivia aureolilacina: 1 flower, 2-3-4 outer, middle and inner perianth segments, x 1.0

Bolivia. Province of Sud Cinti. Department of

Fig. 66
Lobivia aureolilacina sp. nov.

Chuquisaca. Above Impora 2,750 m. April 1958. M. Cárdenas No. 5529 (Type) in Herbarium Cardenasianum.

Obs. This Lobivia of the appearance of an Echinopsis, is distinguished by its spination and the pretty golden yellow lilac flowers.

Lobivia pseudocariquinensis Cárd. sp. nov.

Caespitosa globosa vel conica 6-7 cm. alta 7 cm. crassa diluto viridis. Costis plus minusve 20 acutis in tubercula securiformia 6 mm. alta, 1 cm. lata solutis.

Fig. 67
Lobivia pseudocariquinensis sp. nov.

Areolis 1.5 cm. separatis, ellipticis obliquis 6 mm. long. diluto cremeis tomentosis. Aculei non distinguentes in radiales aut centrales plus minusve 8 radiantes flavi 5-20 mm. long. subulati. Flores pleurogeni 3-3.5 cm. long. 2.5-3 cm. a faucis lati, tubulosi. Ovario 8 mm. diam., squamis crassis viride purpureis 2 mm. long. acutis, pilis densis albis praedito. Tubus 18 mm. long. parce superne patens, squamis paucis 5 mm. long. acutis purpureis, pilis albis instructus. Phylla perigoni exteriora lanceolata 12 mm. long. magenta; phylla interiora lanceolata 10 mm. long. superne rubra, inferne aurantiaca. Stamina inferiora ex fundo tubi usque 5 mm. infra stamina superiora 1.5-2 long. Stamina superiora 5 mm. long. Filamenta alba vel flavescentia. Antherae flavae. Stylus 2-2.5 cm. long. albus gracilis, 6 radis stigmaticis albis gracilibus coronatus.

Patria: Bolivia. Provincia Bautista Saavedra. Departamento La Paz, prope Charazani, 3,000 m.

Caespitose globose 6-7 cm. high, 7 cm. broad, light green. Ribs about 20 acute broken in hatched tubercles 6 mm. high 1 cm. wide. Areoles 1.5 cm. apart elliptic 6 mm. long oblique light cream felted. Spines not differentiated into radials and

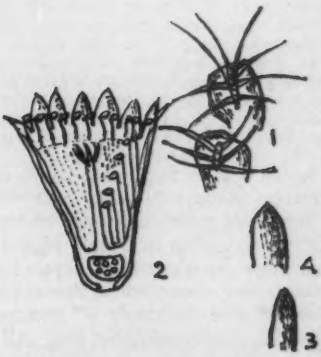

Fig. 68
Lobivia pseudocariquinensis: 1 areoles, 2 flower, 3-4 outer and inner perianth segments, x 1.0

centrals, about 8 spreading yellowish 5-20 mm. long. Upper areoles with very short light yellow spines. Flowers from the lateral upper section of stem 3-3.5 cm. long 2.5-3 cm. limb tubulous. Ovary not distinct from the tube 8 mm. diam. with fleshy green purplish 2 mm. long acute scales bearing dense white hairs. Tube 18 mm. long slightly widening above with few 5 mm. long purplish acute scales which bear white hairs; upper scales with few brown hairs. Outer perianth segments lanceolate 12 x 5 mm. magenta; inner segments lanceolate 10 x 5 mm. bright red above orange yellow below. Stamens in two rows; lower ones from the bottom of tube to 5 mm. below upper stamens 1.5-2 cm. long; upper stamens 5 mm. long. Filaments white. Anthers bright yellow. Style 2-2.5 cm. white thin. Stigma rays 6 yellow 3-4 mm. long thing. Interior of the flower tube white.

Bolivia. Province of Bautista Saavedra. Department of La Paz. Charazani, 3,000 m. April 1957. M. Cárdenas No. 5530 (Type) in Herbarium Cardenasianum.

Obs. This cactus recalls *Lobivia cariquinensis* Cárd. from which it differs by its shorter not curved yellow spines, shorter and broader flowers, shorter stamens and different color of stigma rays.

Fig. 69
Rebutia candiae sp .nov.

Rebutia candiae Cárd. sp. nov.

Globosa caespitosa 2-3 cm. alta, 4-5 cm. lata atro viridis apice depressa. Costis 15-20 spiraliter dispositis in tubercula 5 mm alta, 10 mm. lata solutis. Areolis 6-8 mm. inter se distantibus linearibus ellipticis 5 mm. long. cremeis tomentosis. Aculeis pectinatis 12-14 cormo adpressis 3-7 mm. long. gracilibus flavis. Flores numerosi ex parte laterali vel at basim cormi coronan dispositi. Alabaster conicus atro viridis. Flores urceolati parce zygomorphi 2.5-3 cm. long. Ovario 3-4 mm. diam. globoso atro purpureo viridi, squamis glabris 3 mm. long. atro viridis albo marginatis praedito. Tubus abrupte patens, squamis glabris, mucronatis atro viridis instructus. Phylla perigoni exteriora spathulata 12 mm. long. inferne flava superne viridiscentia; phylla interiora lanceolata 12 mm. long. inferne dilute flava superne aureo flava. Stamina ex fundo tubi usque ad basim petali 1 cm. long.; filamenta aureo flava. Antherae albescentes. Stylo 1 cm. long. gracilis, inferne viridiscenti, superne flavo albescenti, 6 radis stigmaticis gracilissimis albescentibus coronato. Fructu globoso 5 mm. diam. bruneis glabro, squamis latis praedito. Semina non nitentia 1-1.4 mm. long. atro brunescentia.

Patria: Bolivia. Provincia Ayopaya. Departamento Cochabamba prope Tiquirpaya 2,800 m.

Obs. Species detectori Ing. Daniel Candia dicata.

Caespitose, globose 2-3 cm. high, 4-5 cm. broad, very dark green, depressed at top. Ribs 15-20 spiraled, broken in 5 mm. high 10 mm. broad tubercles. Areoles 6-8 mm. apart linear elliptic 5 mm. long, cream felted. Spines pectinate 6-7 at each side of the areole 3-7 mm. long. In old plants there are spines 2 cm. long. All spines thin acicular straw yellow color. Top depression of the plant with spines directed upwards. Flower buds conic, dark green. Flowers numerous from the lateral lower section of stem funnelform 2.5-3 cm. long, 3-3.5 cm. limb. slightly zygomorphic to urceolate. Ovary 3-4 mm. diam. globose dark green purplish with 3 x 2.5 mm. mucronate dark green, white framed scales. Tube abruptly widening above with 5 x 3 mm. dark green pinkish below mucronate scales. Outer perianth segments spathulate 12 x 15 mm. yellow, greenish above; inner segments lanceolate 12 x 4 mm. light yellow below, golden yellow above. Stamens from the bottom of tube to the base of petals about 1 cm. long; filaments golden yellow; anthers whitish. Style 1 cm. long thin, free from the base greenish below, whitish yellow above. Stigma rays about 6, very thin 4 mm. long, whitish. Fruit globose brownish 5 mm.

Fig. 70
Rebutia candiae: 1 flower, 2-3 outer and inner perianth segments, 4 areoles, 5 fruit, x 1.0. 6 seeds x 5.0

diam. glabrous. Seeds 1-1.4 mm. long, brownish black puncticulate not shining.

Bolivia. Province of Ayopaya. Department of Cochabamba. Near Tiquirpaya 2,800 m. March 1955 D. Candia. No. 5531 (Type) in Herbarium Cardenasianum. Cotype in National Herbarium of the Smithsonian Institution.

Obs. This pretty cactus looks like *Rebutia arenacea* Cárd. but differs clearly by the color of stems, the structure of spines and shape of flowers.

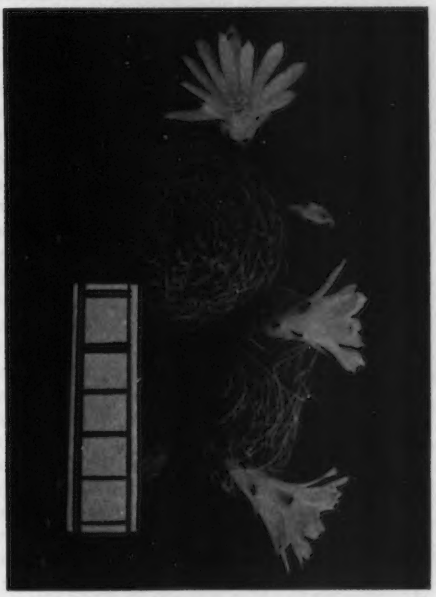

Fig. 71
Rebutia menesesii sp. nov.

Rebutia menesesii Cárd. sp. nov.

Globosa depressa 1.5-2 cm. alta 3.5-4.5 cm. lata atro viridis. Costis 14-18 spiraliter dispositis, in tubercula 2-3 mm. alta, 4-6 mm. lata solutis. Areolis 5-8 mm. remotis, albo tomentosis. Aculeis pectinatis 10-12 setosis 3-25 mm. long. albis vel roseis, pubescentibus. Flores numerosi ex basim cormi in coronam dispositi, infundibuliformes 3-4 cm. long. Ovario 3 mm. diam. atro flavo, squamis 1-1.5 mm. long. acutis glabris atro rubes praedito. Tubus 2 mm. crassus supra ovarium, superne patens, squamis 2-3 mm. long. purpureis instructus. Phylla perigoni exteriora 18 mm. long. sulphuris flava, apice purpureo; phylla interiora lanceolata 11 mm. long. temperate flavo albescentia. Stamina ex fundo tubi usque ad basim petali; filamenta aureo flava, filiformia; antherae albescentes. Stylo papilloso filiforme superne albescente, inferne viridiscente, 3 lacinis stigmaticis albidis coronato. Fructu globoso 6 mm. diam. atro rubeo, squamis latis, viridibus albo marginatis praedito. Semina atra 1 mm. diam. non nitentia, puncticulata.

Patria: Bolivia. Provincia Ayopaya, prope Naranjito, 1,600 m.

Obs. species detectori Elias Meneses dicata.

Globose, simple, flattened 1.5-2 cm. high, 3.5-4.5 cm. broad slightly umbilicate at top, very dark green. Ribs 14-18, spirally disposed, broken in roundish 2-3 mm. high, 4-6 mm. broad tubercles. Areoles 5-8 mm. apart white felted. Spines pectinate bristle-like 10-12 white or pinkish, 3-25 mm. long, pubescent. Flowers numerous from the base of stem funnel shaped 3-4 cm. long, 3 cm. limb. Ovary 3 mm. diam. dark yellow covered by several 1-1.5 mm. long acute dark red scales. Tube 2 mm. thick above ovary widening slightly above with 2-3 mm. long purplish acute scales. Outer perianth segments

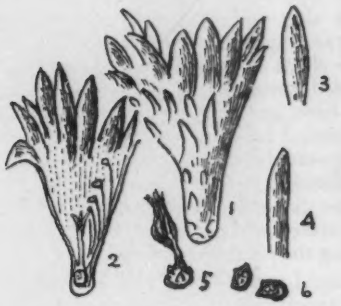

Fig. 72
Rebutia menesesii: 1-2 flower, 3-4 outer and inner perianth segments, 5 fruit, x 1.0. 6 seeds x 4.0

18 x 3 mm., sulphur yellow purplish at tips; inner segments lanceolate 11 x 2 mm. light yellow whitish at base. Stamens from the bottom of tube to the base of petals; filaments golden yellow, filiform; anthers whitish. Style papillose, filiform whitish above greenish at base. Stigma rays 1.5 mm., whitish, 3 in number. Fruit globose 6 mm. diam. dark red, covered by broad white framed green scales. Seeds black 1 mm. diam. not shining, puncticulate.

Bolivia. Province of Ayopaya. Department of Cochabamba. Near Naranjito, 1,600 m. May 1958. E. Meneses, No. 5532 (Type) in Herbarium Cardenasianum. Cotype in the National Herbarium of the Smithsonian Institution, U.S.A.

Obs. This new Rebutia is distinguished by its long curved and pubescent spines.

M. Cárdenas
Cochabamba. University of "San Simón"
April 1960

EDITOR'S NOTE

Copy for the Journal should be typed in order to have it published promptly. Your cooperation will be a great help to your Editor.—S.E.H.

An Excursion to Peyote Land

EDITOR'S NOTE: This article was received anonymously through the mails and we are publishing it because of its interest. We cannot always guarantee publishing unsigned manuscripts.

Interested as I am in everything concerning cacti, I had long been curious about peyote (*Lophophora williamsii*). It has figured prominently in the religion of Indians[1] [2], and the experiments of scientists and writers[3], and I finally became convinced that I too must experience its effects. After reading the account of an Englishman[4] who had an impressive series of hallucinations after consuming only one plant, another man and myself decided to follow his procedure. Two plants were cut up, mixed into a salad, and washed down with sweet lemonade; the meal was bitter and quite repugnant to our taste. We sat around for hours waiting for our first vision to appear, but nothing resulted except an uncomfortable feeling in our stomachs. It was apparent that either individuals reacted differently to peyote or the amount of alkaloids varied among the plants themselves.

Later I met someone who had had a satisfactory experience with peyote, and I and a third person met one evening at his house for another attempt. It had been agreed that we should each consume five "buttons", which are the dried, above-ground portions of the plants. We removed the areolar wool and proceeded to transfer the plants to our stomachs, a horribly disagreeable task because it was impossible to avoid tasting them. I would break off a piece the size of a pea, crush it with my teeth, then quickly wash it down with milk. The bitterness was not very noticeable this time but the taste was so vile it was difficult to keep from gagging. All my life I had stopped eating anything if it tasted unpleasant and it was now difficult to go against this reaction; after an hour I had managed to force down three plants, the pauses between bites growing progressively longer. The other novice among us was also unable to finish his share, and finally we powdered what was left and swallowed it in gelatin capsules. This might seem the easiest way to take peyote, but apparently chewing partly predigests it and one's poor stomach is not so overwhelmed as when capsules are used. The main thing is to avoid extreme nausea, otherwise one may throw up and have undergone a distasteful meal for nothing.

An hour after eating his first plant, the experienced member of our group was already feeling the influence of the drug, while I was noticing a warm sensation in my arms, as though heating wires were buried just under the skin. After a bit, when we were all feeling rather strange, we listened to a recording of Beethoven's Ninth Symphony. This was quite a revelation—I had heard this work so often that for years I had avoided listening to it, yet I now realized I had never really heard it till this moment. It is nearly impossible to describe such a subjective experience, and I can only say that the music had a luminous, living quality that was absorbed and dispersed throughout my whole body rather than merely heard through my ears. The orchestral climaxes carried me upwards almost physically, the contrasting let-downs were shocking in their sudden silence and calm. I repeatedly burst into nervous laughter at certain tones or rhythms, a reaction the others did not share.

By now a paradoxical functioning of my time-sense was apparent. A short melody would seem to take half an hour in playing, yet at the same time the whole hour-and-a-half work appeared to last no more than fifteen minutes. This phenomenon also occurred when I listened to the others talk: a sentence would take an interminable time to be completed and then would often be nearly meaningless unless I made a great effort to recall how it had begun. All this was associated with a closing-in of my mental horizons, for it was now difficult to think of anything that had happened this day, of what I had planned for tomorrow, or of any place outside these walls.

As I sat there my optical sense gradually changed, the most famous effect of peyote. Here again it is impossible to communicate exactly what I saw—though we all three agreed, more than half-seriously, that for the first time we were seeing the actual appearance of things. Every object in the room seemed to have a life of its own; plants on the window-sill perched like birds on a fence, some producing a pleasant reaction, others being faintly disturbing. A picture on the wall was a window on another world, in which objects slowly shifted and receded into the distance. Colors, though identifiable with those I already knew, impinged more vividly on my eyes, with a glowing, almost emotional quality. I was highly conscious of texture, the deep shagginess of a rug, the cracks or wrinkles on the wall; one could stare endlessly at the patterns in a rug or in the rungs of a chair.

1. Weston La Barre, *The Peyote Cult;* Yale University Press, 1938.

2. Slotkin, J. S., *The Peyote Religion;* University of Chicago Publ. in Anthropology, 1956.

3. Aldous Huxley, *The Doors of Perception;* Harper & Bros., 1954.

4. Seabury Edwardes in Nat. Cact. Succ. Journ. 8:59-60, 1953.

Fig. 73
After taking an injection of sulfate of mescaline (the major alkaloid of peyote), the Roumanian artist, Mold, created this painting. The first colored visions appeared after two hours "in blue and violet, with varying contours . . . a monastery with isolated towers partly hidden by arabesques of spiral lines, double or mixed, solid or of dots of different colors, reuniting in clusters resembling lightning flashes. In the center are various crosses, at top and bottom are chains and two acanthus leaves . . ." Reproduced from J. Soulaire, *Cactus et Médecine;* Paris, 1948.

Later I looked at some books of art reproductions. Even conventional art now had an entirely novel aspect, but the fantastic work of Beardsley, Ensor, and particularly the Tenniel drawings for "Alice in Wonderland", were almost unbearable to observe because their distortions and conceits had become heightened to a painful degree. Even the pages of print were alive, the words floating above the paper and shifting position slightly as my eyes passed over them; the various type-styles produced quite different effects and word-meanings were subtly changed.

At midnight we became curious about the outside world and walked two miles to the other man's house. The act of walking presented no difficulties except when going through doors or down stairs, our ability to judge distance and proportion being slightly impaired. As we passed along the street of a residential section we found the world indeed changed. We stared at the glowing street-lights as a child would gaze at his first brightly lit Christmas tree. Cars floated down the street with strange humming or snuffling sounds; it was difficult to relate their progress with ours, and in crossing a street we soon found it safest to wait on a corner until none were in sight. One car came past pushing another, which caused us much hilarity, but I now have no idea why.

Each house we passed had its own personality. Many struck us as comical, and we drew each other's attention to the more entertaining ones. Grotesque gables, overly-ornate porch-columns and window-curtains, the leaning slope of a roof, an oddly pruned shrub, all of these we had seen countless times, yet in a sense had never seen till now. Over and over we stared with delight at the texture of a lawn lit by light from a window, a coarse gravel park-way, or an uneven sidewalk. Many yards contained flowers of unbelievable beauty: a large Pleroma, covered with the most outrageously purple flowers and softly lit by street-lights, so overwhelmed us that we sidled past it in awe; a group of white asters seemed like tiny kites flying on swaying strings, the white petals standing out with startling clarity against

the night; another shrub with sprays of tiny flowers appeared to be sprinkled with glowing specks of white light, so great was the contrast of flower and shadow.

Although few people were on the streets at midnight, I felt sure that each was aware and disapproving of our condition; at the same time I knew our appearance and actions were quite normal. When several persons were walking about the street at once it seemed to me they were converging on us for some reason. An old man sitting on a porch was looking at us sideways and with a knowing, contemptuous air—yet I'm sure now that he was merely watching the passing world as old men often do. This minor persecution complex of mine did not seem to be present in my two companions, who at one point assured me that the cat glaring malevolently at me from under a bush was really a very *nice* cat.

When the main street of town was reached we gazed in fascination at its endless extent, rimmed by flashing stop-signals, garish neon signs and display windows. Up this celestial highway (which I had always considered a rather drab and grimy street) drifted an occasional roaring car, its most characteristic feature radically distorted: a low, foreign make seemed squashed as by a giant's foot, while one of older style wallowed along like a bloated whale.

When we reached the other house the influence of the drug was at its strongest. My dizziness was more pronounced and my stomach was swollen and aching; if I stared for long at one object my nausea would increase. Each of us lay down or sprawled in a chair, absorbed in his own reactions to this oddly changed world. Though fully dressed, I was alternately sweating or chilled, and finally had to wrap myself in a blanket. Unlike many who have eaten larger quantities of peyote, neither then nor later did we see anything that "wasn't there", though all objects were abnormal in aspect and would change position slightly each time I blinked. However, each time I kept my eyes closed the most entertaining displays of colors and forms would continually flash across my lids; they were like the shifting, gaudy designs made by a kaleidoscope, though few were symmetrical and the colors were always changing : melting gold ingots, splattering cascades of mixed paints, checkerboard patterns, leaping lines of color, each design blending with the next and never returning. Interspersed with these were frequent bursts of sounds that I was quite aware I was not hearing with my ears but, somehow, was *seeing* in my mind. Usually these "sounds" were of a muted, fast-playing organ, and the entrancing thing was that each burst changed quickly but imperceptively into a colored pattern, so that at times it was impossible to distinguish what I heard from what I saw. It was as though my senses were controlled by a keyboard instrument on which someone was improvising at random.

None of us slept an instant all night, yet morning came with great swiftness, absorbed as we were in such experiences as these. Although we decided to walk back to the other house, I was so nauseated and lethargic I lacked the initiative to start. Sitting limply in a chair, I would observe my arms lying in my lap like two disembodied limbs; when I mentally ordered them to rise nothing would happen for several seconds—then, reluctantly, they would slowly move. The others were better coordinated physically and finally coaxed me into leaving.

The walk back was just as strange as the one the night before, though in a different way. Now, in place of street-lights, bright sunshine revealed the world in startling detail, some of which I reacted to strangely. At one place the sidewalk, divided into squares, resembled a great ladder reaching up to the main street; I was climbing this ladder with such ease that I seemed to be floating upwards, but the wide street I was approaching looked impossibly high to climb over. Further on we passed a dachshund who appeared to have his legs entirely sunken in the ground, and his harsh bark was a physical blow to our ears. The newspapers on their corner racks entertained us considerably, the headlines being strangely significant or utterly lacking in any sense whatever; for some reason words enclosed in quotation marks produced an indescribable effect.

Back at the house we ate a few things our upset stomachs would tolerate, though hunger was hardly present. We listened to a recording of the Berlioz Requiem and looked at each other in disbelief during its climatic moments; the composer had surely meant it to sound this way, but who else, besides ourselves, had ever heard it thus? I was also sensitive to the sounds that are always going on around us unnoticed. Stop a moment and listen carefully to all the noises you can hear—now imagine them greatly intensified in clarity, though not in volume. I sat in that room for hours, hardly moving, listening to the hum of an icebox, a tap running, foot-steps, a passing car, a dog's bark, the yell of a child, a myriad of unidentifiable sounds. We passed the whole afternoon this way, rarely speaking and never bored, occasionally noting with astonishment how quickly the day was passing.

When I got home that evening, twenty-four hours after my encounter with peyote, I still felt a bit dizzy and objects were far from normal in appearance. Though I had been awake for two days I was not in the least drowsy, yet after going to bed I slept for thirteen hours. Next day

I felt myself again and the world had regained its usual, comparatively uninteresting appearance.

I don't intend to take peyote again, not only because of its disturbing effect on my stomach, but also because in California it is now an illegal drug. This law, which even prohibits the cultivation of the plant, seems needlessly severe. Peyote is not a true narcotic, for it is not habit-forming, or poisonous if taken in large quantities, nor does it cause withdrawal symptoms or anti-social acts. Its only conceivable danger would arise if a user drove a car or crossed a busy street when his judgment of time and distance was impaired—but this impairment is also caused by alcohol, which is not illegal; furthermore, under the influence of peyote one's good sense is not as likely to desert one as it would from drinking. The basic reason for the outlawing of peyote seems to be the traditional puritanism of our culture, which was also responsible for that curious farce, prohibition. Of course, I am not advocating that the human race go about in a continually drugged state, or that an abnormal view of the world is preferable to the normal one; in any case, the disagreeable taste and physical effects of peyote would discourage all but a few from trying it even once. But there will always be those who will accept discomfort in order to glimpse themselves and the world from an entirely new viewpoint. The Indians founded their Native American Church on peyote, and its use is an intrinsic part of their ceremonies; state restrictions on the drug have therefore been interpreted by some courts as an interference with religious freedom. Many artists, musicians and composers are also interested in trying peyote, for of course they are deeply concerned with the visual and auditory senses—yet, unlike the Indians, there are for them no legal loopholes that would allow its use.

Even the average person will find his perception heightened by an experience with peyote. As we mature we tend to see things as we remember having seen them before, and thus our senses become so insensitive that we no longer fully appreciate what is around us. To most people a certain tree, for example, may seem common, ugly and altogether uninteresting—but this is merely due to lack of perception. After seeing the trees during my walk that night I am convinced that even the most inferior and wretched tree in the world can be no less than a living miracle; yet how many passers-by would notice the interplay of light and shadow within its depths, the creaking, rustling life-noises, and the incredible texture of its branches, leaves and bark? Once, for a few hours, I sensed these things, and I can only hope this awareness will never fade completely away.

CRIME SELDOM PAYS!

Dear Botanic Garden:

When I started collecting succulents and cacti I had no idea how obsessed I should become. Not until what I did last Sunday did I realize I am hooked as a drug addict is hooked.

A few crassula leaves (some with infant leaves already formed at their tips) might, it is true, have been lost on the steps from which I snitched them. They were loose, they were there, I did not have them—so I took them. I think I could ultimately justify that on the theory that a careless foot, a carefree wind, almost anything, might have given them less than the comfortably placed pots in which they are now resting.

There is, however, no possibility of self-justification in what I did at the frames of adromischus. At first I was satisfied with copying the names (for possible future purchase) of those I thought most interesting. My only specimen is A. festivus. It was when I saw a loose leaf—a callous already formed at its tip—lying beside A. undulatus that all sense of honor left me. I popped it into my purse. It was only minutes later, when a big fat leaf with its pink, hair-fine roots already showing that the amoral fever really took hold. That one was A. triebneri. Five smaller ones followed the first two into the darkness of my purse—but guilty glutton that I was, I didn't even write their names down.

Now it is Thursday. I cannot enjoy them. I cannot destroy them. I am miserable.

This is all I can offer: I noticed you had no specimens of the Stapelieae, those wierd starfish flowers whose culture is almost identical to the Adromischus. Can I expiate my guilt by offering you starts of those? I have about eight—but only four could be slipped now. I would be glad to slip the remaining ones as they mature.

Actually, I'd like to give them to you anyway . . . their late-summer/early-fall blossoming is wonderful to see. I buy them from Johnson's Cactus Gardens in Paramount, California.

I am so uncomfortable. HELP ME!

REPORT ON THE MAMMILLARIA SOCIETY

It has been nearly a year since the inception of the "Mammillaria Society", and now we have 125 members from all over the world.

The best way to judge a society is to look at the February "Journal of Mammillaria Society". Mr. W. F. Maddams' "Beware", an article dealing with wrongly named plants now in circulation; two articles describing Mams. One is devoted to species nova since Dr. Craig's "Mammillaria Handbook". The other describes species which are fairly common in collections; this month M. durispina. Other articles deal with the growing of Mams. This month marks the beginning of one of our enterprises, the seed distribution. Through this the Society plans to distribute at a nominal cost, the correctly named seeds of Mammillaria species as well as other genera related to Mammillarias. For the future is planned a type collection of all Mammillaria species and varieties, and a reference book.

If you are interested write Mr. D. E. Watling, 45 Montague Road, Richmond, Surrey, England.

CHANGE OF ADDRESSES

Address changes are a serious problem to your Editor. Please cooperate and send the change of address by the first of the month, otherwise we will have to make a change of 50c for return postage and remailing another copy.

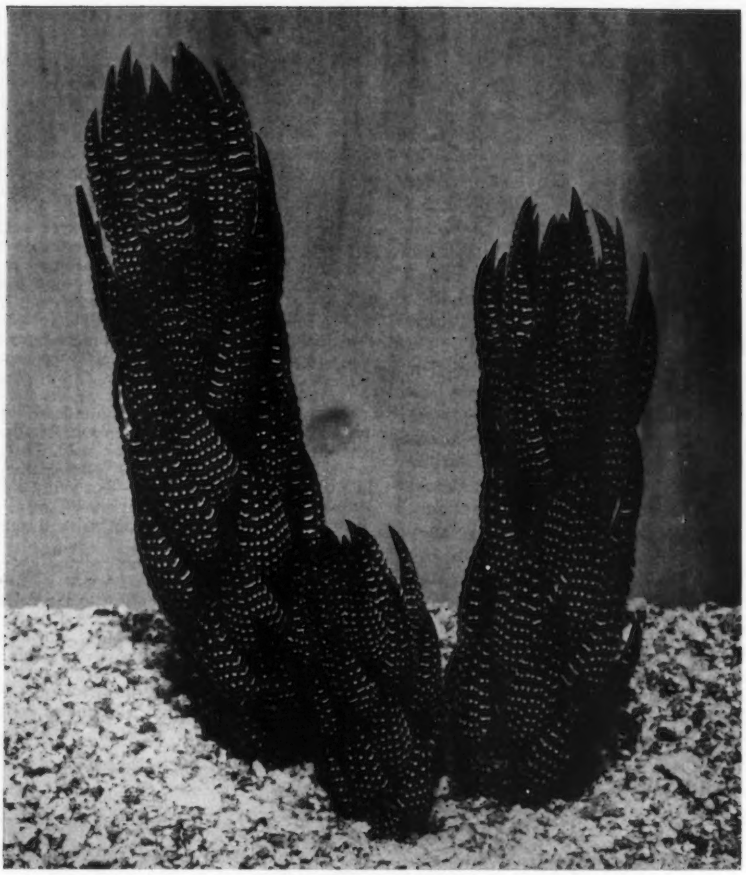

Fig. 74
Haworthia reinwardtii var. *huntsdriftensis* G. G. Smith. nat. size.

Notes on Haworthias

J. R. Brown

Haworthia reinwardtii var. **huntsdriftensis** G. G. Smith in Journ. So. Afr. Bot. X (1944) 14, Pl. I & fig. 3.

Plant with leafy stems to 17 cm. long, to 4 cm. in diam., more or less erect, proliferous from the base and forming clusters.

Leaves crowded, multifarious, ascending, incurved, 3.5-4 cm. long, to 14 mm. broad towards the base, 5 mm. thick at mid-leaf, lanceolate, acuminate; face of leaf flat near base slightly rounded above, smooth, light to dark green, with a lightly raised concolorous lengthwise middle line and one on each side uniting with the middle line towards the tip; back of leaf rounded, somewhat obliquely keeled, with II traverse rows of white transversely oblong rather small tubercles, some of which are confluent transversely, the rows about 2 mm. apart at mid-leaf, dark green.

Locality: Cape Province. Albany Division.

Named for Hunt's Drift on the Fish River where this Haworthia was discovered.

Smith states, "Compared with *Haw. reinwardtii* Haw. the tubercles are smaller and less numerous on back of leaf and the face is quite smooth. In general appearance it resembles *Haw. committeesensis* but the back tubercles are smaller and more sparsely arranged, the leaves shorter and more incurved at apex and the fertile bracts are shorter."

This is a neat appearing Haworthia but of no special distinction. The photo shown here is of a division of this Haworthia from the collection of G. G. Smith.

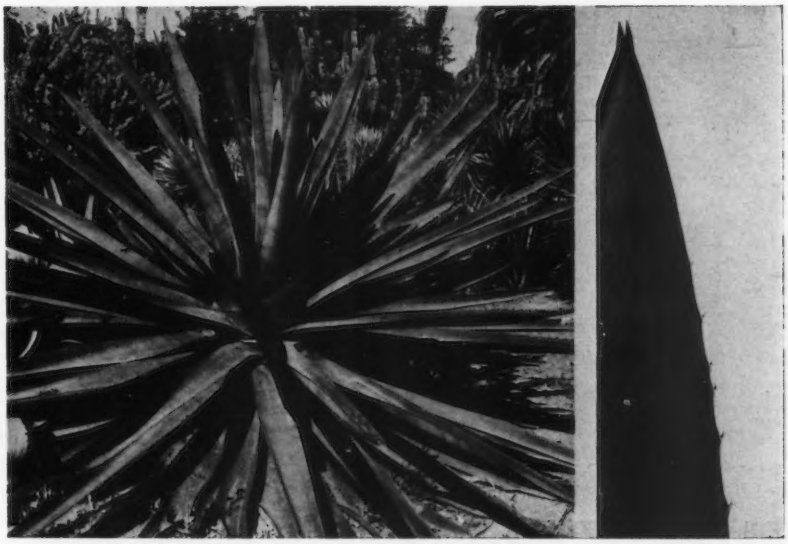

Fig. 75
Agave tequilana. Left: rosette grown in the Huntington Botanical Garden, San Marino, Calif., approx. 1/12 natural size. Right: leaf tip showing small short terminal spine and small upcurved marginal teeth, from same rosette, slightly reduced.

CULTIVATED AND NATIVE AGAVES IN THE SOUTHWESTERN UNITED STATES

AUGUST J. BREITUNG
1416 S. Glendale Ave., Glendale, California

PART 15

Agave tequilana Weber, Bull. Mus. Hist. Nat. 8: 220, 1902.

Distribution: Mexico; type from about Tequila.

Rosette shortly caulescent, stoloniferous; leaves straight, stiff, 1 to 1.5 m. long, 8 to 10 cm. wide, acuminate, flat at base, otherwise shallowly concave, light bluish-green, and persistently glaucous; spine reddish-brown, conical, 10 to 12 mm. long, 3 to 4 mm. wide, teeth triangular, upcurved, 2 to 3 mm. long, 3 to 10 mm. apart, the intervening whitish margin slightly concave; inflorescence 6 m. high, panicle oblong, occupying about one half the length of the scape, the lower branches shorter, the middle longest, 60 to 80 cm. long; flowers 6 cm. long, capsules 5 cm. long, bulbils frequent. July-Aug.

Agave pacifica Trelease in Standley, Trees & Shrubs of Mexico, U.S. Nat. Herb. 23(1): 118, 1920.

A. yaquiana Trelease in Standley, Trees and Shrubs of Mexico, Cont. U. S. Nat. Herb. 23(1): 120, 1920.

A. oweni I. M. Johnston, Calif. Acad. Sci. series 4, 12; 999, 1924.

Distribution: Mexico; Sonora, Sinaloa and Tepic, type from Creston Island, Mazatlan, Sinaloa.

Rosette 1 to 1.5 m. in diameter, stemless, stoloniferous; leaves 3.5 to 5 cm. wide, 7.5 dm. long, stiff, yellow-green, lightly glaucous and zoned; spine conical, round-grooved at base, red-brown, 5 mm. wide, 15 to 25 mm. long, often abruptly contracted and slender above the decurrent base; teeth 15 to 25 mm. apart, 3 to 6 mm. long, upcurved, triangular, intervening cartilaginous margin straight or very slightly hollowed, inflorescence 3 m. high, flowers greenish-yellow, 50 mm. long, perianth tube openly conical, half as long as the segments; capsules 25 mm. wide, 45 mm. long, stipitate, beaked. June.

Fig. 76
Agave pacifica. Left: a group of flowering specimens in the Huntington Botanical Garden, San Marino, Calif., greatly reduced. Right: leaf detail from type of A. oweni, approx. ¼ natural size.

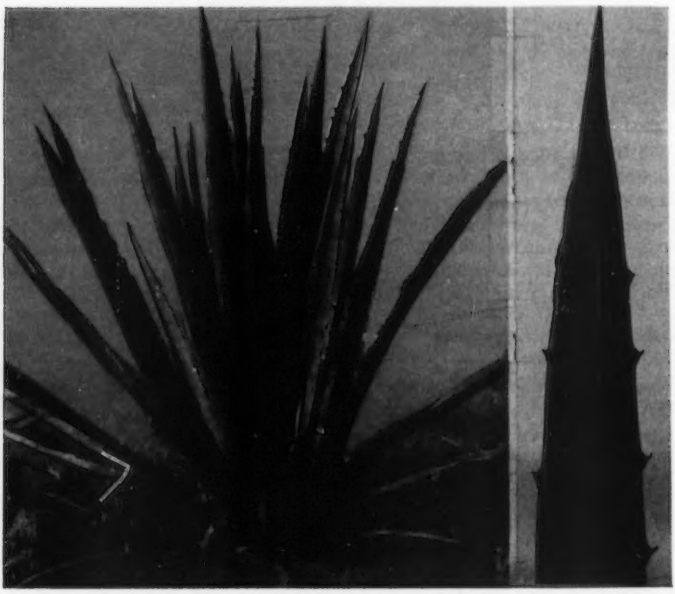

Fig. 77
Agave deweyana. Grown by Dr. Howard S. Gentry, Murrieta, Calif., approx. 1/10 natural size. Right: leaf detail from same rosette, approx. ⅓ natural size.

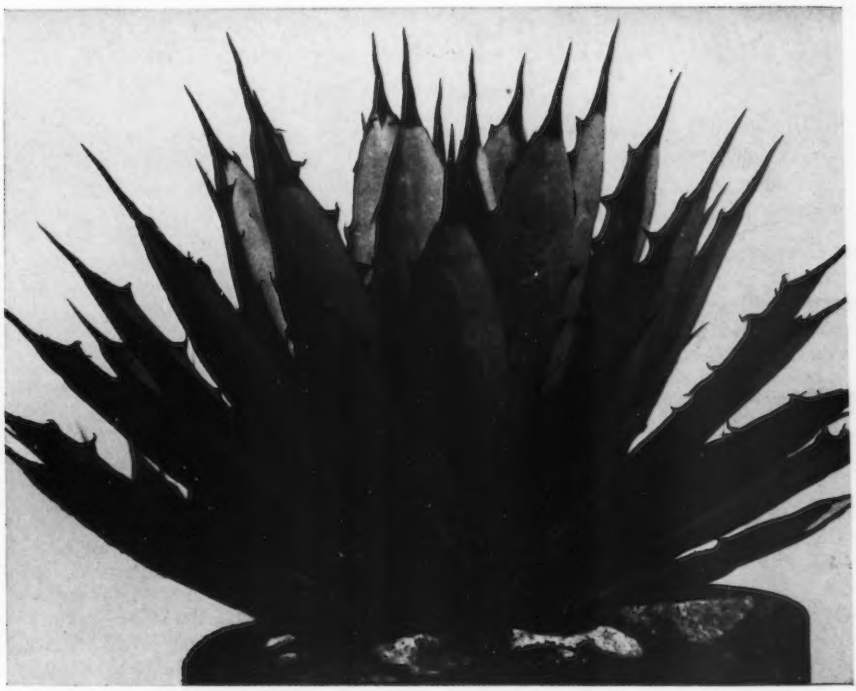

Fig. 78
Agave macroacantha. Characteristic rosette showing comparatively large, black armature, the terminal spine intruded in the green tissue; grown by Dr. Shelley A. Swift, Salt Lake City, Utah.

Agave deweyana Trelease, Trans. Acad. St. Louis 18: 35, 1909.

Distribution: Mexico: Tamaulipas and Veracruz, type from Victoria, Tamaulipas.

Rosette 2 to 2.5 m. in diameter, stemless, stoloniferous, leaves numerous, 3 to 5 cm. wide, 1 to 1.5 m. long, lance-linear, acuminate, yellow-green, transiently glaucous and sometimes transversely banded on the back, fibrous striate in drying; spine 3 to 4 mm. wide, 15 to 40 mm. long, brown, nearly straight and conical, broadly round-grooved in the lower third, shortly decurrent; teeth similarly colored, 15 to 40 mm. apart in the middle, reduced or absent toward the tip, 2 to 3 mm. long, slender, upcurved or inflexed, their bases somewhat lenticular, the intervening translucent margin nearly straight; inflorescence 3 to 6 m. high, the upper half densely oblong-paniculate; flowers unknown; capsules 25 mm. wide, 35 mm. long.

Agave macroacantha Zuccarini, Act. Acad. Caes. Leop. Carol. 16: 676, 1833.*

Distribution: Mexico; Puebla, type cultivated in Europe, probably from Tehuácan.

Rosette 4 to 6 or rarely 8 dm. in diameter, stemless or shortstemmed, stoloniferous; leaves numerous linear-lanceolate, stiff and rigid, glaucous, 2 to 4 cm. broad; 1.7 to 2 (or 3) dm. long; spine 4 to 6 mm. wide, 15 to 25 mm. long or more, dark brown or blackish, almost triangular, broadly grooved above, slightly decurrent, not always reaching the first pair of teeth, intruded ventrally into the tissue; teeth 2 to 5 mm. long, 15 to 20 mm. apart, heavy-based, mostly upcurved; inflorescence 2.5 to 3 m. high, slender; panicle open with 10 to 15 branches; flowers about 5 cm. long, greenish-yellow; capsules 4 to 4.5 cm. long. June-July.

*For complete synonymy see Trelease in Rep. Mo. Bot. Gard. 18: 247-251, 1907.

A Study of the Proposed Genus Roseocactus[1]

EDWARD F. ANDERSON[2]

ARIOCARPUS Scheidweiler, Bull. Acad. Sci. Brux. 5: 491-492. 1838.

Subgenus 1. ARIOCARPUS

Subgenus 2. ROSEOCACTUS (Berger) W. T. Marshall, Cact. Succ. Jour. 18: 55. 1946.

Rosecactus, as genus, Berger, Jour. Wash. Acad. Sci. 15: 43. 1925.

Roseocactus, as subgenus of *Ariocarpus,* W. T. Marshall, Cact. Succ. Jour. 18: 55. 1946.

In 1925, Alwin Berger, after an investigation of plants and herbarium specimens of the genus *Ariocarpus,* published an article proposing a new genus in the Cactaceae. He named this genus *Roseocactus* in honor of Dr. J. N. Rose, co-author of *The Cactaceae.* It was Berger's belief that some of the species in the genus *Ariocarpus* differed sufficiently to justify placing them in a separate genus. The plants possessing a longitudinal areolar groove, *A. fissuratus* (fig. 2, 17), *A. kotschoubeyanus* (fig. 12), and *A. lloydii,* were placed in the new genus, while a single species, *A. retusus* (fig. 1, 16), was kept in *Ariocarpus.* He did not mention *A. trigonus* (fig. 5).

Berger (1925) concluded that the two genera were different on the basis of two characters:

"I finally have come to the conclusion that there are indeed two distinct genera, differing not only in the nature of the tubercles but also, and chiefly, in the origin of the flowers."

He went on to add the following about the areoles:

"If we break off an old tubercle of the Texan plant [*A. fissuratus*] or of *Ariocarpus lloydii* and cut it longitudinally, we shall see that the fissure, filled with grayish hairy wool, corresponds to an areole and we shall discover in its lower part the remains of the fruit and perhaps even a few seeds . . . The tiny areole at the top of the tubercles of the true *Ariocarpus* of Scheidweiler [*A. retusus*] is wholly different. It does not show any sign of having ever produced flowers. In fact, if we break off one of the tubercles on a dried specimen, we shall detect in the axil between the tubercles, at the base of the tubercle but rising from the axis, the remains of the old fruit with numerous seeds, which have been hidden there for years."

Berger's second criterion for creating *Roseocactus* was flower origin. He believed that the flower originated from within the lower part of the areolar groove of *A. fissuratus* and from the axil between the tubercles in *A. retusus.*

Berger's decision to create a new genus was strictly artificial, that is, he looked for differences between the two groups and ignored the similarities. I have strived, in this study, to approach the group naturally, trying to note the similarities and weighing these against the differences. By this method a grouping may be defined based more accurately on all aspects of botanical analysis.

Two field trips to Mexico were made (Anderson, 1958) to gather material and to study the plants in their native state. Numerous photographs were taken and several hundred plants were brought back to California and placed in pots. Experiments were carried out on living material, and herbarium specimens were made. Specimens from other herbaria were borrowed in connection with the materials collected on the two field trips, and variations of these specimens (including some type material) were recorded.

The groups were studied from the standpoint of both similarities and differences, and conclusions were then drawn at the completion of the study. The similarities between *Ariocarpus* and *Roseocactus* are as follows:

Habitat. Ariocarpus and *Roseocactus* are found only in the Chihuahuan Desert of Texas and Mexico, and are restricted to calcium-bearing soils. In most localities occurrence on limestone is obvious, but in some areas a 10% hydrochloric acid reaction test was necessary for conclusive proof. The soil in which these plants grow is also neutral or slightly alkaline. Most species usually grow near the summits of low hills; rarely are they found on flat, poorly drained soil. Plant associations are similar for the two groups, with variation being accounted for by difference in rainfall and temperature. Plants commonly found with *Ariocarpus* and *Roseocactus* are *Agave lecheguilla, Jatropha spathulata, Larrea divaricata, Opuntia* spp., *Mammillaria* spp., *Echinocereus* spp., and *Yucca* spp. No differences could be noted in the ecological requirements of the two groups (figs. 3 and 4).

Development of seedlings. Buxbaum (1950)

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[1]A more technical article dealing with *Roseocactus* was published earlier by the author in Amer. Jour. Bot. 47: 582-589. 1960, under the title: A revision of *Ariocarpus* (Cactaceae) I. The status of the proposed genus *Roseocactus.*

[2]This study was made possible through a grant to Pomona College by Dr. Gordon A. Alles of Pasadena, California. The author also wishes to thank Dr. Lyman Benson for his advice and criticism.

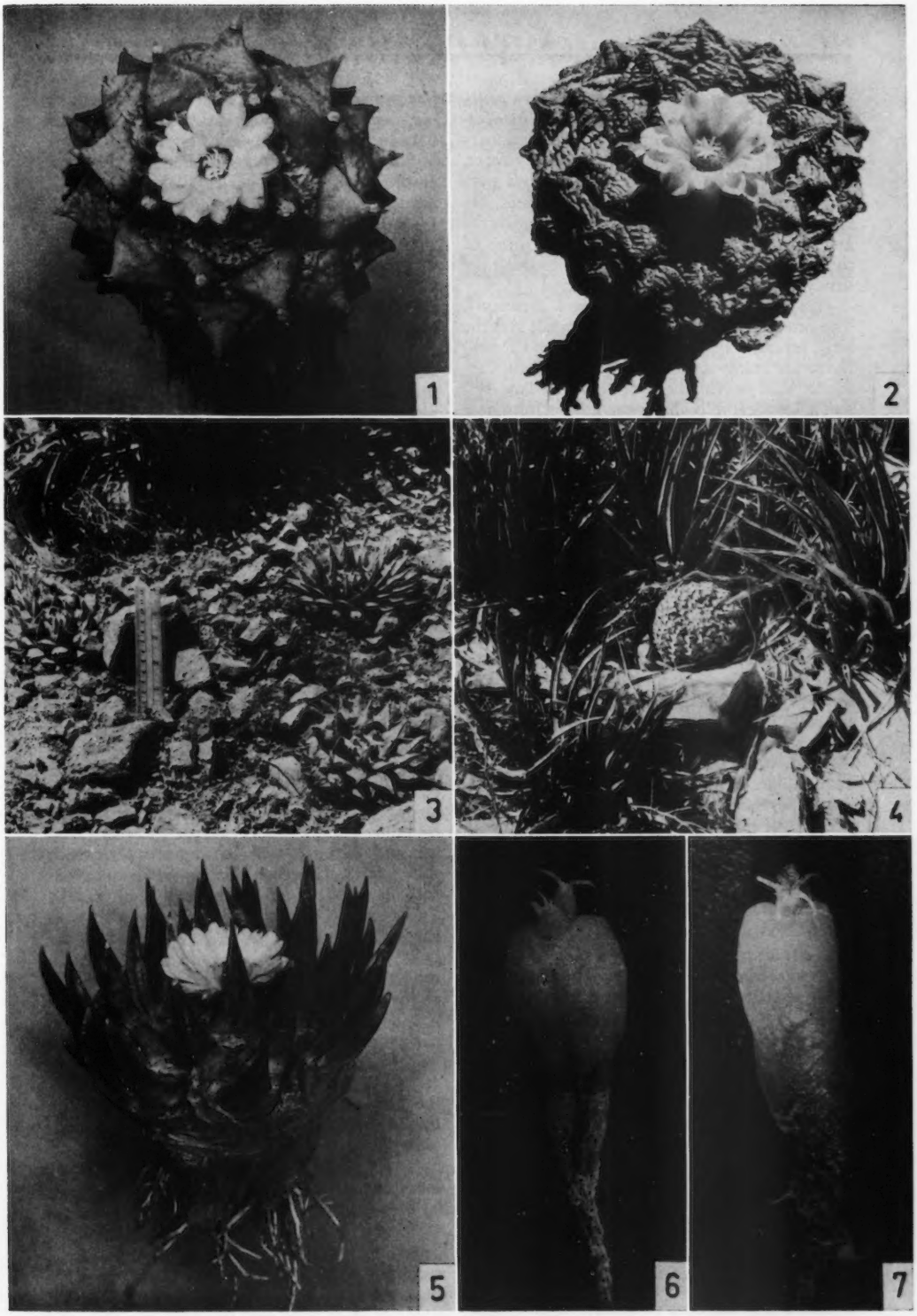

Fig. 79

1. *A. retusus*. x ½. (See fig. 16 for tubercle details). 2. *A. fissuratus*. x ½. (See fig. 17 for tubercle details). 3. Location near El Huizache, San Luis Potosí, Mexico with *A. retusus*. 4. Location near Parras, Coahuila, Mexico showing *A. fissuratus* var. *lloydii*. 5. *A. trigonus*. x ½. 6. Six-month old seedling of *A. retusus*. x 7. 7. Six-month old seedling of *A. fissuratus*. x 7.

compared seedlings of *Ariocarpus, Roseocactus, Encephalocarpus, Obregonia,* and *Leuchtenbergia,* and noted several important "evolutionary trends". He also stated that *Ariocarpus retusus, Roseocactus fissuratus,* and *Leuchtenbergia* were alike in many ways in seedling development. My observations were that seedlings of *Ariocarpus* and *Roseocactus* are similar from the time of their emergence from the seed coat through the first year of development (figs. 6 and 7).

Presence of mucilage canals and reservoirs. The extensive system of mucilage canals and the large central reservoir in *Ariocarpus* and *Roseocactus* are unknown in other genera of the Cactaceae, and development of this mucilage system is identical in both genera. Canals form near the vascular bundles and extend into the shortened stem area in which a reservoir is located. These canals are as much as 2 mm. in diameter (figs. 8 and 19), and the reservoirs have been found up to 20 mm. in diameter (figs. 9 and 20). As mucilage canals are probably unique to these two groups, this common feature strengthens the proposition of recombining them into a single genus.

Seed structure. A recent study of the seeds of the Cactaceae was by Buxbaum (1953), who published numerous drawings and discussed the "taxonomic value" of seeds. Craig (1945) and Boke (1959 and oral communication) have also found seeds important in taxonomic work. Buxbaum states that there are several characters of the seed, which showing variations, are of taxonomic value. They are the hilum and strophiole, the shape, the color of the integument, and the structure of the outer testa. On the outer surface (testa) the size and density of the nipples are said to be of significance. The application of the above characters to taxon analysis is dependent upon the uniformity of the characters within the lower taxon.

The seeds of both *Ariocarpus* and *Roseocactus* were studied. Small differences in shape were noted in some seeds, but the overall shape and structure were not variable (figs. 10 and 11). The two groups are similar in all the diagnostic characters of seed structure as outlined by Buxbaum.

Fruiting habit. Ariocarpus and *Roseocactus* have similar fruits and means of seed dispersal (fig. 12). Descriptions of the fruits of the two groups have been omitted from many works because they are seldom seen. The masses of wool in the centers of the plants usually hide the fruits at maturity; in fact, the fruits often develop, mature, and decompose while hidden among the wool. They persist there until water or some other agent removes them.

Origin and structure of flowers. One of Berger's (1925) two main criteria for establishing *Roseocactus* was the location of flower origin, but evidently he did not dissect living material I studied living specimens of both groups while in flower and found little difference in the point of origin of the floral organs. The floral parts develop from the bases of the tubercles (figs. 13 and 14).

Other floral characters are similar within the two groups. The naked ovary has been a diagnostic character used in descriptions and keys by Britton and Rose (1923), by Bravo (1937), and by Marshall and Bock (1941).

Pollen grain structure. There has been little intensive work on the structure of pollen grains in the Cactaceae. Kurtz (1948) concluded that identification of genera and species of cacti on the basis of pollen is impracticable. Studies of *Ariocarpus* bear out this opinion, but the remarkable similarity of the pollen between the two groups is of significance. Pollen of *Ariocarpus* is tricolpate (the three aperatures are more than twice as long as wide in outline) and the exine is three-layered. Contrary to Kurtz's observations on the cacti, the exine is not pitted. The resemblance to pitting is actually a reticulum formed by knob-like pila which are an outward extension of a layer of the exine. Pollen grain details may be seen in figure 18. Pollen grain size within the genus varies sliightly, from 60-85 μ.

Chromosome number. Most cacti are reported as having a chromosome number of $2n = 22$. Root tips of *Ariocarpus* were studied and several counts were made, all being $2n = 22$ (figs. 21 and 22). This number is different from that found by Takagi in 1938 (reported by Darlington and Wylie, 1955) in *R. fissuratus,* which was $n = 38$. However, this number is questionable in the light of other work done on the Cactaceae. No evidence of polyploidy was found.

Trichome development. Only a few genera in the Cactaceae have the degree of trichome development found in *Ariocarpus* and *Roseocactus.* The development, structure, and appearance of trichomes in both groups are similar. The "wool" develops abundantly in the floral areolar regions at the bases of the tubercles and also in the areolar grooves or areolar regions on the tips of the tubercles when these structures are present. The trichomes are multicellular and uniseriate, and they develop from the epidermal layers in the areolar regions.

Tubercle structure. Microscopic analysis of the internal structure of the tubercles of both *Ariocarpus* and *Roseocactus* shows that the layers of cutin and the epidermis are analogous in structure and appearance. Some cactus genera have uniquely-shaped epidermal cells, but such is not the case with the two groups under consideration.

Alkaloidal properties. Schultes (1937a, 1937b), Reti (1950), and other investigators reported certain alkaloids to be present in *Ariocarpus* and *Roseocactus,* but only in *R. fissuratus* had the alkaloid been identified. Ewell (1896) reported this alkaloid to be anhaline. Several precipitate-producing reagents were tested to determine the presence and location of anhaline. Phosphotungstic acid proved to be the best reagent because of its speed of reaction with the alkaloid and its non-reaction with starch. Live plant materials of all species of the two groups were tested and were found to react, indicating the presence of anhaline. Few other cacti have been reported having this alkaloid; consequently, this provides additional evidence of a close relationship of the two groups.

In the study of the two groups not all characters were found to be alike. The following differences were found between *Ariocarpus* and *Roseocactus.*

Flower color. The color of flowers of plants included in *Ariocarpus* is white in *A. retusus* and cream (yellow) in *A. trigonus.* Occasionally both these species show a reddish tint to the midribs of the outer perianth segments. All flowers in *Roseocactus* are magenta or occasionally white.

Areolar groove. The presence of an areolar groove was one of Berger's two criteria for proposing *Roseocactus.* Studies indicate that *Roseocactus* has monomorphic areoles with both floral and spiniferous areolar areas developing within the same meristem and never splitting off. *A. retusus,* on the other hand, has areole dimorphism with the original single growing point becoming elongated and then dividing into two portions. However, *A. trigonus,* a species not treated by Berger, differs from both the above groups as the spiniferous growing point never develops from the original meristem. All species begin with an original meristematic area, with differentiation occurring during elongation and maturation of the tubercle. Not always do species develop without variation, for specimens of *R. fissuratus* have been found which lack the longitudinal areolar furrow (fig. 15), and specimens of *A. retusus* occasionally occur with no rudimentary spiniferous areolar areas at the tips of their tubercles. It is believed that all species have areolar meristematic areas with potential floral and spiniferous areas, but that growth and maturation can occur in one of three places in relation to them. (1) In *Roseocactus* elongation occurs beneath the spine area (fig. 23-1). (2) In *A. retusus* growth and elongation is between the points of origin of the spines (rudimentary) and flowers, thus producing areolar areas at both ends of the tubercle (fig. 23-2). (3) In *A. trigonus* growth and elongation is distal from both the areolar areas, leaving them at the base of the tubercle (fig. 23-3).

Tubercle divergence. It has been noted that the divergence of tubercles is different between *Ariocarpus* and *Roseocactus.* The difference is due to the shapes of the tubercles, especially at their bases. If the longer tubercles of *Ariocarpus* were shortened and rounded at their tips, they would take on generally the same appearance as *Roseocactus.*

Trichome texture. Trichome length and texture vary according to the habitat. The coarser hairs found on some plants are probably an adaptation for protection from abrasion by wind-blown sand. In cultivation plants tend to have longer and silkier hairs. *A. trigonus* has shorter and coarser hairs than *A. retusus,* because the tubercles are more divergent and less compact in the former, allowing abrasive elements such as dust and sand to penetrate.

Conclusions. In the foregoing discussion the similarities and the differences of *Ariocarpus* and *Roseocactus* have been considered. Evidence is clear that there are many similar features between the two groups, some of which are probably unique among the Cactaceae. The areolar groove is variable but is nonetheless a difference. However, with the desire to create a natural grouping based on the many similar characters rather than a few differences, I conclude that *Roseocactus* should not be considered a separate genus. The differences pointed out in this article are excellent characters to use in distinguishing plants on the subgeneric and specific level. I believe the genus *Ariocarpus* should retain the species placed in *Roseocactus,* and the proposed generic name *Roseocactus* should be relegated to the formal rank of subgenus as Marshall (1946) proposed earlier.

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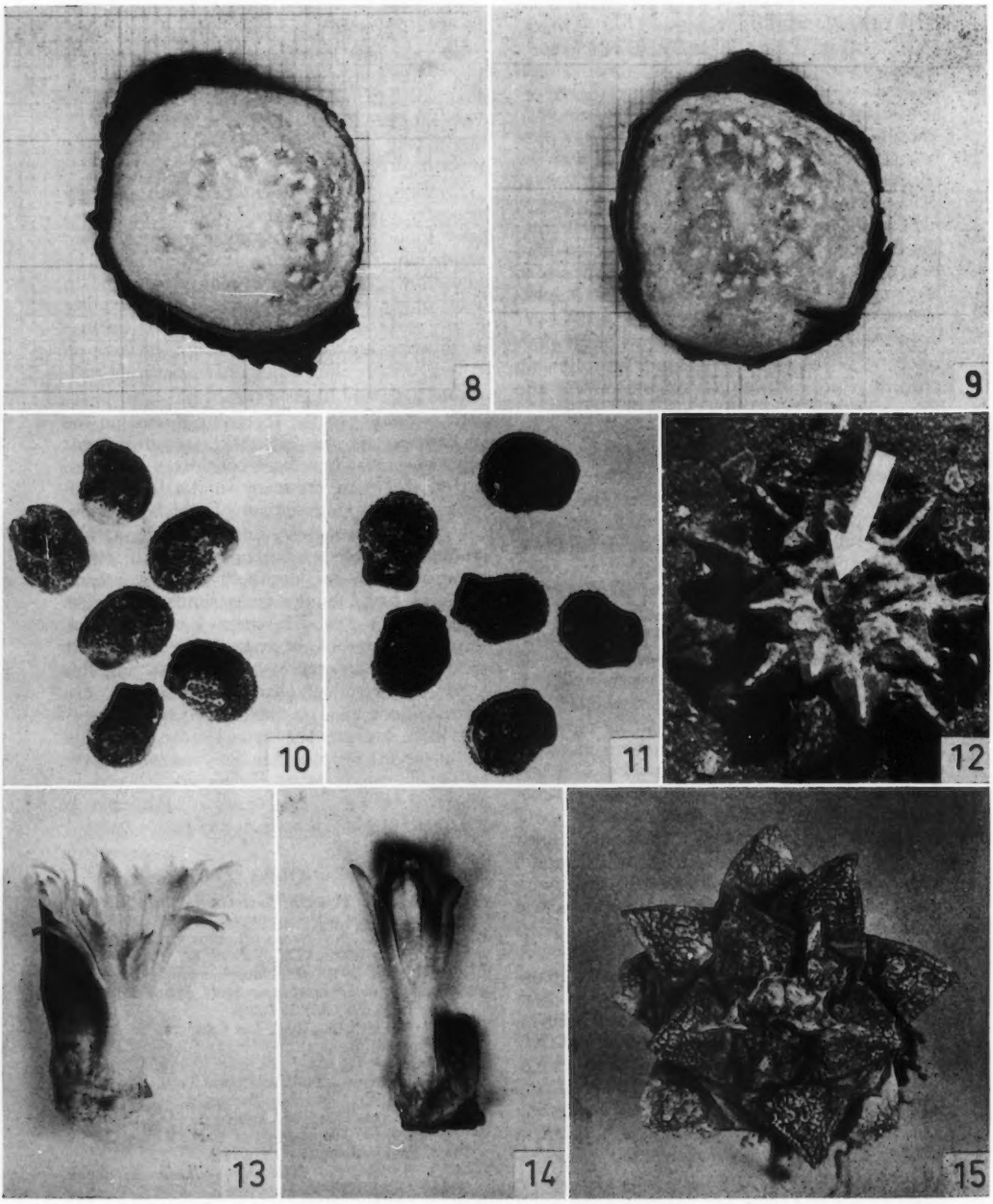

Fig. 80
8. Mucilage canals as seen in an unprepared fresh section of *A. fissuratus*. x ¾. 9. Mucilage reservoir as seen in an unprepared fresh section of *A. fissuratus*. x ¾. 10. Seeds of *A. retusus*. x 10. 11. Seeds of *A. fissuratus*. x 10. 12. *A. kotschoubeyanus* with fruit (arrow). Natural size. 13. A tubercle of *A. retusus* with a flower originating from its base. x ¾. 14. A tubercle of *A. fissuratus* with a flower originating from its base. x ¾. 15. A mature plant of *A. fissuratus* with tubercles lacking the usual longitudinal areolar groove. Natural size.

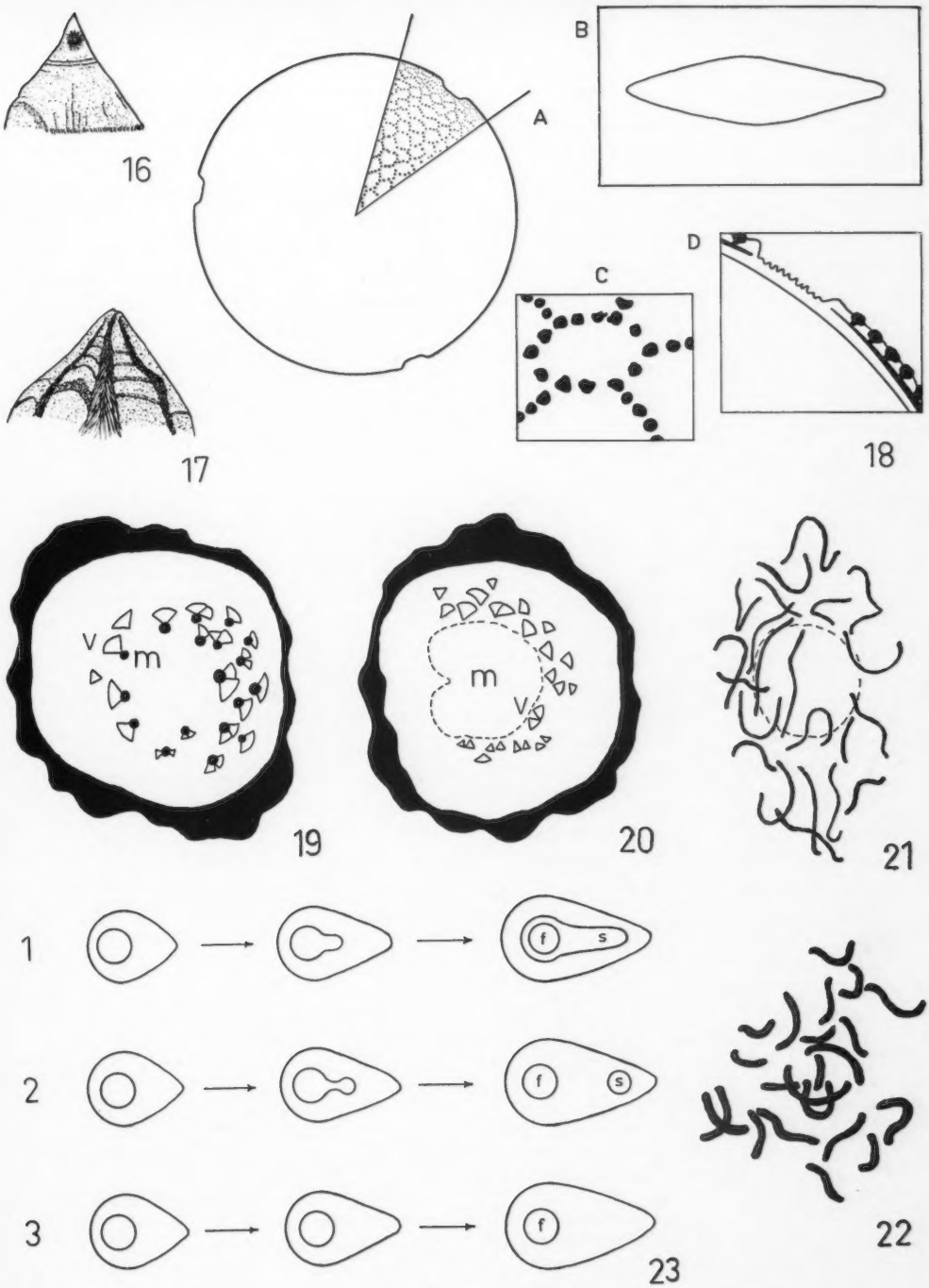

Fig. 81

16. A tubercle of *A. retusus* showing the much-reduced areolar region at the tip. About natural size. 17. A tubercle of *A. fissuratus* showing the longitudinal areolar furrow. About natural size. 18. Diagrammatic drawing of a pollen grain of *Ariocarpus*. A. Polar view showing the exine with the reticulate occurrence of muri. x 700. B. Outline of an aperture. x 7000. C. Arrangement of pila forming the muri. x 7000. D. Exine structure. x 7000. 19. Drawing corresponding to fig. 8 showing the mucilage canals (m, black dots) and the vascular bundles (v, triangular areas). 20. Drawing corresponding to fig. 9 showing the mucilage reservoir (m, dotted line) and the vascular bundles (v ,triangular areas). 21. Root-tip chromosomes of *A. retusus*. ($2n = 22$). x 2500. 22. Root-tip chromosomes of *A. fissuratus*. ($2n = 22$). x 2500. 23. A diagrammatic comparison of the different methods of tubercle development in *Ariocarpus*. (1) *A. fissuratus* and *A. kotschoubeyanus;* (2) *A. retusus;* (3) *A. trigonus;* f, floral primordia; s, spine primordia.

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